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ART. I.—*On Three several Hurricanes of the American Seas and their Relations to the Northers, so called, of the Gulf of Mexico and the Bay of Honduras, with Charts illustrating the same;* by W. C. REDFIELD.

Introduction.

IN some former investigations of the hurricanes of the Atlantic Ocean and other seas, I have been enabled to trace the progress of these tempests in a westerly direction while in the intertropical latitudes, and thence in a recurved or northeasterly direction through a portion of the temperate zone.* The routes pursued by several of these storms have been delineated on my chart of 1835, which, with several additions, is appended to this communication.†

Of the storms which have been thus examined, some have been traced in their daily progress for a distance of 2500 or 3000 miles; while the places of their first origin, as well as of their final disappearance, remain still undetermined.

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* See this Journal, (first series,) April, 1831, (Vol. XX,) Art. IV:—October, 1833, (Vol. XXV,) Art. XV:—October, 1836, (Vol. XXXI,) Art. VIII:—January, 1839, (Vol. XXXV,) Art. II, p. 201:—January, 1842, (Vol. XLII,) Art. XII.

† Chart II.

The nearly symmetrical forms of the semi-orbital curves which are shown in the routes of these storms, and their obvious relations to the observed courses of the great aerial currents, both in the intertropical and temperate latitudes, appear to warrant the conclusion that they all pertain to one prevalent system of atmospheric dynamics, and that these several storm-routes indicate, with much certainty and precision, the general or aggregated course of circulation pursued by the great currents or moving strata of the lower atmosphere, at the several periods and localities in which these storms have appeared.

Some of these storms, however, have been traced only in their westerly course in the lower latitudes, and have not been followed in a subsequent northeasterly course; but in these cases there appears no good reason to doubt the ultimate extension of the semi-orbital curve of the storm-path into higher latitudes.

The storm-routes which have been established by the inquiries of Col. REID, on both sides of the equator, constitute an important addition to our knowledge on this subject, and are found on the charts which accompany his valuable work on the law of storms.* The elaborate investigations made by Mr. PIDDINGTON of Calcutta, have also contributed much to our knowledge of the courses pursued by Asiatic storms.† Other and distinguished writers have shown, to some extent and at different periods, a corresponding course in other tempests, while moving through a portion of the temperate latitudes, but with no clear indications of an orbital or semi-orbital course of progression in the body of the storm.‡

Antje's Hurricane of August and September, 1842.

Three several storms, the routes of which are marked I, II and V, on my storm chart of 1835, were traced only in their westerly

* "An attempt to develop the Law of Storms, by means of facts arranged according to place and time;" by Lieut. Col. W. REID, C. B., F. R. S.; WEALE, London, 1838 and 1841.

† See eleven successive Memoirs "on the Law of Storms in India;" published by Mr. PIDDINGTON, at Calcutta. Mr P. infers that some storms of the China sea have probably pursued a southwesterly course; but we can hardly admit this anomaly without full evidence derived solely from the progress of the storm over successive and extended localities.

‡ Since these pages have been preparing for the press, I have met with Mr. THOM's "Inquiry into the Nature and Course of Storms in the Indian Ocean south of the Equator." (London, 1845.) This interesting work fully confirms the vorticular rotation and orbital progression of the Mauritius hurricanes, in directions of revolution which are counterwise to the storms of the northern hemisphere, as had been shown by Col. REID. It will doubtless prove valuable to navigators.

course and in the lower latitudes.* To this group I have now to add the observed route of the storm which appeared in the American seas at the end of August and in the early days of September, 1842, the route of which is marked XII on the same chart.

This hurricane is distinguished as having pursued a course which is nearly due west, so far as it has been successfully followed by our inquiries, and its progress and observed phenomena will now be considered.

Our earliest notice of this gale is August 30th, in lat. 25° 54′ N., lon. 63° W., where the schooner *Antje* was dismasted by it, and our latest is September 8th, in Mexico, lat. 23° 28′ N., lon. 102° W.; the meridional distance between these points being equal to thirty nine degrees of longitude.

In submitting a condensed statement of the various observations obtained, I shall first exhibit the reports from places which were on or near the right margin or border of the gale as it proceeded westward; second, those reports which relate to the left margin or southern border of the storm's path; and, lastly, those which relate to the right center and left center of the advancing gale.

Right Margin of the Gale.

1. From Bermuda, which is over 400 miles† N. 13° W. from the position assigned to the Antje on the 30th of August, and apparently beyond the direct influence of the gale, we have the following observations.

Date.	Hours.	Winds.	Force of wind.	Aspect of weather.	Barometer.
August 30.	noon.	W. N. W.	2 (light breeze.)	blue sky.	30·07 inches.
31.	noon.	W.	2 " "	blue sky.	30·11 "
September 1.	5 A. M.	N. E. by N.	6 (single reef gale.)	cloudy.	30·05 "
"	noon.	N. E.	4 (moderate breeze.)	cloudy.	30·09 "
"	9 P. M.	N. E.	6 (single reef gale.)	cloudy and rain.	30·09 "
2.	noon.	N. E.	5 (fresh breeze.)	blue sky.	30·13 "

[We find here a moderately high barometer throughout, with light and faint winds on the 30th and 31st. On the 1st of September, when the gale should have passed far to the westward in its course, we have fresh winds from northeast, which winds existed in like

* See Chart I.

† The miles referred to in this paper will be statute miles of 5280 English feet, unless otherwise expressed.

force, at that time, as far west as the American shores and over a large extent of country, north of Florida and bordering on the Gulf of Mexico.]*

2. Savannah, Geo., lat. 32° 05′, lon. 81° 07′, Sept. 1st, wind N. E., A. M. cloudy, P. M. fair; 2d, cloudy, A. M., wind E., P. M. N. E.; 3d, wind N. E., fair; 4th, wind N. E., P. M. cloudy; 5th, fair, A. M. wind E., P. M. S. E.†

3. St. Augustine, E. Florida, lat. 29° 40′, lon. 81° 35′, Sept. 1st, fair, with high winds from E.; 2d, cloudy, high winds from N. E.; 3d, wind N. E.; 4th, *rain* A. M., *fair* P. M., *wind N. E.*; 5th, fair, wind N. E.; 6th the same.

4. Palatka, East Florida, on the river St. John, lat. 29° 38′, lon. 81° 47′, Sept. 1st, wind E., cloudy, N. E., fair; 2d, wind W., fair, N. E., rain; 3d, wind N., cloudy, N. E., fair; 4th, *wind N. E., fair;* 5th and 6th, wind N. E., fair.

5. Fort Micanopy, East Florida, lat. 29° 5′, lon. 82° 5′, Sept. 1st, A. M. wind N. E., fair, P. M. N., rain; 2d, A. M. wind E., P. M. N. E., fair; 3d, S. E., fair; 4th, *N. E., fair;* 5th, *S., fair;* 6th, S. E., cloudy.

6. Fort Brooke, Tampa Bay, (west coast of Florida peninsula,) lat. 27° 57′, lon. 82° 35′, Sept. 1st, wind E., P. M. cloudy; 2d, E., fair; 3d, E., P. M. cloudy; 4th, A. M. N. E., fair, P. M. *E., rainy;* 5th, *E., cloudy;* 6th, E., fair.

7. Cedar Keys, East Florida, (northeast angle of the Gulf of Mexico,) lat. 29° 9′, lon. 82° 56′, Sept. 1st, A. M. wind S. W., fair, P. M. N. E., rain; 2d, E., fair, P. M. rain, high winds; 3d, E., fair; 4th, E., fair; 5th, A. M. *N. E.*, P. M. *E., fair;* 6th, E., fair.

8. Fort Fanning, Florida, lat. 29° 38′, lon. 83° 9′, Sept. 1st, A. M. wind S., fair, P. M. E., rain; 2d, S., fair; 3d, A. M. N. E., P. M. E, fair; 4th, A. M. N., P. M. E., fair; 5th, A. M. S. E., P. M. S., fair; 6th, E., fair.

9. Fort Stansbury, Middle Florida, lat. 30° 18′, lon. 84° 8′, Sept. 1st, wind E., rain; 2d, A. M. E., P. M. S. E., rain; 3d, A. M. S. E., P. M. E., cloudy; 4th, E., fair; 5th, A. M. N., P. M. S., fair; 6th, A. M. E., P. M. S. E., fair.

10. Fort Pickens, Pensacola Bay, West Florida, lat. 30° 18′, lon. 87° 12′, Sept. 1st, wind N. E., rain; 2d, A. M. N. E., rainy, P. M. E., cloudy; 3d, A. M. N. E., P. M. E., cloudy; 4th, A. M. E., P. M. S. E., fair; 5th, E., fair; 6th, E., fair; 7th, S. E., fair.

11. Fort Morgan, Mobile Bay, Ala., lat. 30° 16′, lon. 88° 10′, Sept. 2d, A. M. wind S., fair, P. M. S. E., rain; 3d, S. E, rainy; 4th, S. E., fair; 5th, S. E., fair, rainy P. M.; 6th, S. E., fair; 7th, S. E., fair; 8th the same.

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* Capt. BEAUFORT's symbols for denoting the strength of winds and the state of weather, which are very generally adopted by English authorities, and to which we must often refer, are substantially as follows:—

The scale of the winds is from 0 to 12, the first indicating a calm and the last the full force of a hurricane. These numbers are not used with precision, but 5 and 6 may be viewed as pertaining to a storm-wind, when found in proximity with a gale or hurricane and in directions which are accordant with its winds, and even 4 or 3 may sometimes be thus viewed.

The state of the weather is denoted as follows:—

b. Blue sky, with or without clouds.
c. Detached or opening clouds.
d. Drizzling rain.
f. Fog.
g. Gloomy dark weather.
h. Hail.
l. Lightning.
m. Misty or hazy, intercepting view.
o. Overcast with impervious cloud.
p. Passing showers.
q. Squally.
r. Continuous rain.
s. Snow.
t. Thunder.
u. Ugly and threatening appearance.
• Under any letter denotes an extraordinary degree.

The reader will find frequent occasion to refer to this note.

† Most of the following observations in the United States are from the returns made to the Surgeon General's Office, from the military posts, kindly furnished by Surgeon General LAWSON.

The scale of the wind's force prescribed for the United States military posts consists of ten numbers, in which 9 denotes a hurricane force, and 10 a violent hurricane. Thus a like force may be sometimes expressed by a number which is lower by two than in the English scale, which is next mentioned, so far as relates to the higher numbers.

There are some observers who use a scale of only six numbers to express the force of the wind, instances of which will occur in this article.

12. New Orleans Barracks, La., lat. 30°, lon. 90° 9′, Sept. 2d, wind N. E., P. M. rainy; 3d, N. W., P. M. rainy; 4th, N., cloudy; 5th, N. E., cloudy; 6th, A. M. N. E., P. M. S. W., cloudy; 7th, A. M. N. W., P. M. S. W., cloudy.

13. Fort Jessup, La., lat. 31°, lon. 93°, Sept. 3d, wind S., fair; 4th, S., fair; 5th, S., cloudy; 6th, S. E., cloudy; 7th, S. E., cloudy; 8th, A. M. N., P. M. S., cloudy.

With reference to the foregoing observations it is well to state here that the body of the hurricane passed over the southern part of the peninsula of Florida on the 4th day of September, on its route to Mexico. From the 1st to 4th a rain passed over part of Florida in a nearly opposite direction.

Left Border of the Gale.

14. Nassau, N. P., (Bahamas,) Sept. 10th.—The brig *Rolla*, from Glasgow, arrived this morning, having touched at Antigua. She encountered none of the severe weather which was experienced here and at the adjacent islands on the 2d and 3d instant. On the contrary it was a perfect calm. [We must suppose that this vessel first made the latitude of Antigua and then ran to the westward in the usual way. Thus the storm might pass down to the westward on a more northern parallel, without being noticed by the *Rolla* either before or after her arrival at Antigua. See Chart II.]

15. We come next to the well kept log of H. M. S. *Pilot*, then on her passage from Jamaica to Nassau, N. P., the full insertion of which our limits preclude. The *Pilot* was westward of Hayti on the second and third of September, when the gale passed her meridian, working up for the passage between Hayti and Cuba, with easterly and variable winds, moderate in force, "and just feeling it enough to make her testimony highly interesting," as shewn by the following extract: "Sept. 2d, A. M., wind N. E.; out first reef of topsails, set royals and flying-jib: Noon, Cape Maize, [E. end of Cuba,] bore N. 22° E., distant 90 miles; at 2 P. M. taken aback, wind N. N. E.; turned round on the starboard tack; 3 P. M. in royals; 3h 40m. set royals; 5 P. M., wind southward; 7 P. M., wind S. W., in royals; ends calm. Sept. 3d, light variable winds, N. W. to E.; 5 A. M., a breeze from E.; 6 A. M., E. b. S.; 10 A. M., E. S. E.: Noon, Cape Maize, N. 2° W. 58 miles; wind light from E.; 7. P. M., in royals, flying-jib and reef in topsails, wore ship, in top gt. sails; 9h. 50m. P. M., set fore-topmast staysail, down jib, up foresail, lowered topsails to a squall; 11h. 40m. in two reef fore-topsail. Sept. 4th, 1 A. M. hoisted topsail, set foresail, wind S. E. varying to W. and calm, no stars visible; A. M., winds S. E., to E. by N." On the 4th and 5th, from E. end of Cuba to Fortune Island, winds light and moderate, from S. to S. E. [I consider the changes of wind on the afternoon and night of the second as due to the influence of the gale in passing; and the squally or cloudy weather on the night of the 3d as due to the recurrence of the lower trade wind, as disturbed by the passage of the storm on the N. side of Cuba.]

16. From the logbook of H. M. S. *Ringdove*,* sailing from Vera Cruz to Laguna des Terminos on the southern side of the Gulf of Mexico:—Sept. 5th, calms and variable winds in the forenoon, lat. 19° 15′, lon. 95° 8′; P. M., winds northerly, force 4 and 5; Sept. 6th, latter part of night calm, A. M. winds N. N. E., N. W. and westerly, lat. 19° 9′, lon. 93° 31′, P. M. wind W. N. W., 3; Sept. 7th, winds W. S. W. and S. W. by W., 3, lat. 18° 37′ lon. 91° 45′; P. M., light, variable, 1, and calm. On the 8th the wind freshened from S. E.; with a heavy swell from S. E. on the 9th. [The storm appears to have passed the meridian of the *Ringdove* on the 7th, but at a considerable distance to the northward.

17. At Vera Cruz, lat. 19° 12′, lon. 96° 04′, there was no gale at this period.

18. At Tampico, lat. 22° 15′, lon. 97° 50′, the gale was not felt in any force, although this point was near the left centre of the storm. [Had we barometrical observations from

* The logs of the *Pilot* and *Ringdove*, with those of other British ships of war, were kindly furnished by Col. Reid, of the Royal Engineers, now Governor of Bermuda.

Tampico they might serve to show the true state of the storm at that point, which from its position on the eastern coast is sheltered from the force of the westerly winds, which constituted the left hand side of the storm.]

After careful inquiry I cannot find that this gale appeared to the southward of the chain of islands which forms the northern boundary of the Caribbean Sea, nor in that southern portion of the Gulf of Mexico which is known as the Gulf of Campeche.

We will now follow the course of the storm, directly in its path of violence.

Right and Left Center of the Gale.

19. Our first report is that of the Dutch Schr. *Antje*, already mentioned as having been dismasted, Aug. 30th, in lat. 25° 54′, lon. 63°, "in a violent gale from S. and E." [Perhaps this report of the wind's direction is intended for southeastward; *i. e.* "*southward and eastward*," as the phrase is often used by seamen. It is probable that the date is given in nautical time, and applies more especially to the time of the casualty. Thus it *may* refer to the afternoon of the 29th, and to the latter part of the gale. This will agree better with the next report.]

20. At Turk's Island, lat. 21° 30′, lon. 71° 4′, Aug. 30th, "heavy tempest from S. to S. W."

21. The Brig *Helen and Elizabeth* reports a hurricane on the evening and night of Sept. 2d, at Rum Cay and Watling's Island. The latter island is in lat. 24°, lon. 74° 28′, and the effects of the gale were here most disastrous; not a house on the island but had been more or less seriously injured, and most of them were in ruins.

22*a*. A Nassau account, already quoted, shows that the hurricane passed over the Bahama Islands on the 2d and 3d of September. The loss of life and property at these islands is represented to have been very great.

A comparison of the above accounts and positions will show that the Turk's Island date is given erroneously, perhaps in nautical time. These reports are sufficient, however, to show the arrival of the gale on the evening of Sept. 2d at the eastern portion of the Bahama Islands. From these islands to the center of the Gulf of Mexico the reports are sufficiently numerous and full for the objects of this inquiry. The next report, though much abridged, affords a good account of the access and progressive phases of the storm, first on the northern margin and then in the more central portion of its track; showing the direction and modifications of the wind successively induced as the ship and the storm advanced westward in their respective, and, in part, coincident courses.

22*b*. Ship *St. Mary*, Foster, for New Orleans, at noon of Sept. 2d was in lat. 27°, lon. 76°, [then in advance of the northern border of the gale,] "a favorable N. E. wind wafting the ship swiftly to the southward." . . "Low fleecy clouds flew swiftly to the west;" "*a high sea, without any apparent cause*, rolling furiously from E. N. E." On the morning of Sept. 3d, [front centre of the gale then nearly as far westward as the ship,] the wind increased, the east sea had swelled to mountains, the sun shone silvery bright, and the clouds displayed fiery copper tints. At 8 A. M. passed near the Hole in the Wall, [S. E. end of

Abaco, lat. 25° 51′, lon. 77° 11′,] tem. of air 82°, water 81½°, wind increasing, in sudden gusts; sails reduced and well secured. Shortly after noon of the 3d, passed Stirrup Key and entered upon the great Bahama Bank. The wind, from E. N. E., continued to increase, but was fair for crossing these smooth shallow waters. Appearances now altered and the clouds flew to the west with great velocity and low elevation; ship reduced to close-reefed topsails and reefed fore courses. At half-past 8 P. M., departed from the Bank and encountered, in the Gulf of Florida, a heavy breaking sea. The night was dismal in the extreme, but the ship scudded with safety.

After daylight on the 4th, the sea ran very dangerously, and during the morning the clouds came flying from the east with heavy squalls of wind, lightning and torrents of rain. By 10 A. M. the Florida Reef, near to Loo Key, was seen, over which the sea was breaking frightfully, the wind blowing E. by S. About noon the wind had increased to a perfect hurricane; to run was no longer safe, and the ship was hove to with head to the south, under a storm mizen topsail, which soon blew to fragments. At 6 P. M. had drifted into shoal water, but to set sail was impossible, as no canvass could stand, and for four anxious hours the ship drifted to the west. The wind during that long night blew steadily from E. by S. with increasing violence. Towards morning of the 5th it veered gradually to the S. E. and moderated to a hard gale, with heavy rain. Finally, the morning of the 6th brought, in the Gulf of Mexico, a clear sky and a gentle breeze.—(*Jour. of Capt.* FOSTER.)

[The veering of the wind from N. E. to S. E., to the *right* on the compass card, during the storm, together with its force, shows the ship to have been in the right center of the gale, as will appear also from a collation of the other reports. The duration of the gale and the slowness of the changes of its direction, with this ship, are largely due to her westerly progress, which in the later part coincided with the course of the storm.]

23. Brig *Florida Banca*, at noon of Sept. 2d, was in lat. 29° 39′, lon. 75° 54′; took the first of the gale about 10 P. M., wind N. E., veering afterwards to E., at which point it stood at noon of the 3d, about six miles south of the Hole in the Wall. Had the hardest of the gale between Stirrup Keys and the Banks in the afternoon and night of the 3d. (*Journal of Capt.* ELDRIDGE.)

24 *a*. Barque *Rapid*, WARD, bound for Havanna, Sept. 2d, A. M., wind E., five and six knot breeze; lat. obs. 26° 31′. P. M., wind N. E., begins fresh gales and clear weather. At 4 P. M. made the Hole in the Wall, S. W. by W., 15 miles. At 8 P. M. the Hole bore N. E. by E., 7 miles; ends with fresh gales and squally appearance.

Sept. 3d, at 1 A. M., made the Berry Islands bearing W. S. W., five miles, fresh gales and squally, took in main-top gallant sails. P. M., fresh gales and squally; at 2h. 30m. P. M., went off the Bank; wind N. E. by N.; at midnight made the Doubled-Headed Shot Keys and hauled up west.

Sept. 4th, at 2 A. M., the Double Shots bearing E. N. E. about nine miles distant, close reefed topsails and sent down fore-royal yard; at 5 A. M., finding the gale increasing sent down top gt. yards and took in flying-jib boom; reefed all sails and furled them as fast as possible; running before the wind under bare poles, wind N. N. E. At 8 A. M., still scudding, and judging the land of Cuba at not more than ten miles distance, brought the barque to under the main spencer. In less than ten minutes she was hove on her beam ends, the water rushed into the cabin, and every thing was soon washed from the deck. Finding no relief, cut away the mizen topmast to get her off before the wind, rather than founder. Lost the fore-topmast staysail, fore-topmast and head of the foremast, could not get the barque before the wind, and the sea constantly breaking heavily over her. By this time it was noon, and the wind, *which had suddenly shifted*, was blowing a tremendous hurricane from S. to S. W. At 1 P. M. the force of the hurricane began to abate, still blowing very heavy and in squalls. At 4 P. M. more moderate, and at 6 P. M. kept away S. W. under foresail, the wind at S. E. Sept. 5th, at daylight made the Pan of Matanzas. (*Logbook.*)

[It will be seen that the *Rapid* was further south while exposed to the gale, than either of the three vessels last mentioned. The sudden shift of the wind to an opposite direction shows that the barque was at that time near to the axis of the gale, and that this axis passed near to the north coast of Cuba in its westerly progress.]

24 *b*. Capt. WARD states that a Spanish ship was dismasted at Ginger Key, [lat. 22° 53′, lon. 78°,] the hurricane shifting "round the compass."

25. Barque *William Engs*, sailed from Key West, Sept. 3d, at 6 A. M., wind light from N. E. and fine clear weather; at noon sixteen miles S. S. E. from Key West light; barometer 30·10. At 6 P. M. the wind began to freshen, with dark clouds rising at N. and barometer fell rapidly till 8 P. M., when it stood at 29·70. Took in all light sails and put the ship under double reefed topsails; weather continuing to wear the same appearances.

Sept. 4th, at 2 A. M. took a heavy squall from N., which reduced us to close-reefed main topsail; barometer still at 29·70. The wind continued to blow with great violence from N. till 4 A. M., when it began to haul gradually to the eastward, which continued till 8 A. M., when it stood at E. S. E. and blew, if possible, with increased violence. We were now on soundings on the Florida Reef, and gaining nothing off shore, the sea breaking over us and preventing all communication with the cabin, so that the barometer could not be observed. At noon still blowing a hurricane from E. S. E. and continued steady at that point, with squalls of rain, till about 3 P. M., when it began gradually to subside, and at 10 P. M. had so far moderated that we could get up new sails from below and bend them; the wind continued to die away at E. S. E. till it fell calm. The barometer near the close of the gale stood at 30 inches. At noon of the 5th was in lat. 24° 15′, lon. 83° 35′. We judged our position at the commencement of the gale to be in lat. 24° 5′, lon. 81° 25′, making a drift of one hundred and eight miles to the west, which we could account for only by our being on soundings and having a strong counter current. We afterwards made Key West and found our chronometer correct.—(*Letter from Capt.* COE.) [This vessel was clearly in the right side of the gale.]

26. Capt. SMITH of ship *Christoval Colon*, states that on the 4th of Sept. a very heavy gale was experienced at Havanna and Matanzas, commencing at N. about sunrise, at Havanna, and veering westward round to S. S. W., and blowing with great violence for ten hours; causing much damage to the shipping in port. This is confirmed in substance by Capt. Boss of the barque Merchant, from Havanna, who states that by noon the gale had veered to N. W., increasing in force: and also by the statement of Lieut. MCCLURE, commanding H. M. S. Roman, furnished to Col. REID, from which we learn that in the afternoon the gale blew furiously from S. W., and continued from this quarter till 1 A. M. of the 5th, when the wind ceased, but heavy rain continued till 3 A. M.

27. Ship *Hilah*, from New Orleans for New York; Sept. 4th, 11 A. M., in sight of Havanna, a tremendous hurricane from N. W. At 5 P. M. gale increasing, saw the land about 300 yards to leeward; attempted to work the ship off, *when the wind suddenly shifted to S. W.* and blew still heavier. Cut away sails and rigging to save the spars.

28. Brig *Harriet*, in lat. 25° 1′, lon. 84° 9′, experienced a hurricane, lost spars, sails, &c.

29. Schr. *Emporium*, lat. 24°, lon. 84° 15′, in a severe hurricane, lost topmast, sails, &c., and sprung lower masts.

30. The barque *Euphrates*, from New Orleans for Marseilles, was dismasted on the 5th of Sept. in lon. 85° 30′.

31. Ship *Oconee*, from New Orleans, Sept. 5th, 6th, experienced a heavy gale, 100 to 150 miles S. E. of Balize, from N. E. by E. to E. by N., *with a heavy sea running from S. E.* Laid to *with head to S. E.* under close-reefed maintopsail for twenty four hours.—(*Statement of Capt.* JACKSON.)

32. Barque *Columbia*, from New Orleans, crossed the N. E. bar Sept. 1st, and had light winds from E. and E. S. E. till Sept. 4th, when the wind became fresh and squally from N. N. E., lat. 28° 8′, lon. 87° 28′. Sept. 5th, commenced blowing from N. E. with squalls and rain; lat 26° 49′, lon. 86° 51′, the gale increasing and veering to E. N. E. with a heavy sea. Sept. 6th, lat. 25° 31′, lon. 85° 30′; shortened sail to a three reefed maintopsail and main spenser; continued blowing a complete hurricane; from 6 to 10 P. M. expected every moment to see the masts go over the side. Sept. 7th the wind veered E. and abated; lat. 24° 35′, lon. 85° 2′: for two days after the hurrricane *had a very heavy sea from W. S. W.* which led us to expect a renewal of the gale from that quarter, the winds at the time being light from E. S. E. and E.—(*Statement of Capt.* TRUSSEL.)

We now pass to the left side of the storm.

33. The royal mail steamship *Solway*, left Vera Cruz for Havanna in the morning of Sept. 2d, and for the following two days had very fine weather. On the morning of the 5th a strong breeze commenced from E. N. E., (shifting afterwards to N., N. W., W., S. W. and S. E.,) which continued increasing all day, till at night it had amounted to a perfect hurricane; the heaviest of which was from midnight till 4 A. M. of the 6th. The ship lost her sails, but behaved admirably, and during the height of the gale was laid to without steam. The barometer fell from about 30·10 to 29·28, and gradually rose again towards morning of the 6th. The gale subsided as rapidly as it came on, and the morning of the 7th was as fine and the sea as smooth as it had been two days previously. The position of the Solway at noon of the 4th was in lat. 22° 39′, lon. 89° 44′; noon of 5th, lat. 23° 30′, lon. 86° 50′; 6th not given.—[*Letter from Capt.* DUNCAN *to Gov.* REID.—Capt. D. informed Lieut. MCCLURE, commander of the *Roman*, that "he had never witnessed a more terrific breeze or heavy cross sea."]

34. The master of a Hamburg brig informed Capt. COE, of the *Wm. Engs*, that near Cape Antonio [west end of Cuba] the gale commenced at N. and veered by N. W. and W. to S. W.; and that his barometer here fell but 3·10ths of an inch.

35. H. M. S. *Rover*, KEELE, from Tampico for Bermuda; Sept. 5th, lat. at noon 23° 53′, lon. 93°, wind E. N. E., 4, cloudy, barometer 30·05. At 4 P. M. N. by E., 5, clouds and blue sky. Sept. 6th, at 5 A. M. wind N., ship steering E. by N.; the wind increasing and veering to the westward, with a heavy swell from N. W., strength of wind 8 [gale] with rain and ugly appearances, barometer falling. At noon, lat. 23° 49′, lon. 90° 27′, wind 9 [strong gale] with rain and a heavy sea; barometer 29·50. At 2 P. M. wind W. S. W., 10, [whole gale,] o. r. v. At 3 P. M. barometer 29·41, wind 11, o. r. u., with tremendous gusts, the surface sea greatly smoothed by the violence of the wind. I now considered the storm to be at its height, as the barometer began slowly to rise, still blowing hard till 5 P. M. It then gradually decreased and veered round to the S. W., S. S. W., and S., leaving a very heavy sea. At midnight, wind S., 7–9, rain; barometer 29·80. Sept. 7th, begins wind S., 7, o. g.; at 4 A. M. wind S., 6, o. p.; barometer 30; sea greatly abated. At noon, lat. observed 24° 2′, lon. 88° 21′, wind S. E., 5, c. g. Current since noon of the 6th, S. 35° W., 24 miles.—(*Logbook.*)

Our next report is from the right side of the storm.

36. The sloop *Dream*, from Texas for New Orleans, was sunk during the gale, on the 7th of Sept., off Raccoon Point, near lat. 28°, lon. 91°.

Having thus followed the storm over the Bahamas and the Mexican sea, we come now to the reports of its appearance in the northern provinces of Mexico, as found in the Bermuda Royal Gazette.

37. The hurricane reached the town of Victoria,* situated below the table land of Mexico, in lat. 23° 28′, lon. 102°, at 6 A. M., Sept. 8th, 1842. The wind set in at *north*, and increased in violence, from the same quarter, until 1 P. M. It then fell a *profound calm* for five or six minutes, when immediately afterwards the wind came from the *south* with renewed fury. Victoria is a town containing about 4000 inhabitants. Between two and three hundred houses were blown down. Oaks and other stately forest trees were uprooted, and some of them transported 50 or 60 yards. At Victoria the storm set in with heavy rain.—This account is from the Russian Baron KARWINSKY, travelling for his government in Mexico.

38. "At Soto de la Marina, [lat. 23° 42′, lon. 98° 10′,] within 7 or 8 miles of the sea coast, the wind blew as it did at Victoria. Baron KARWINSKY made every inquiry in order to trace its progress in Mexico. He found it proceeded westward but only 60 miles [from Victoria] and there he supposes it to have ceased, and at that distance it must have encountered the high table land.

* La Ciudad de Victoria, or Durango.

39. Mr. STEWART JOLLY, the British Consul at Tampico, to whom we are indebted for Baron KARWINSKY's report, states that at Tampico, during the time when the storm was passing so near there to the north, "it was a dead calm and the air insufferably hot and oppressive."

From the observations above recited, we may derive the deductions and remarks which follow.

Daily Progression of the Storm.

If we take the storm date of the *Antje* as noon of August 30th, we find the rate of the storm's progress from thence to Victoria to have been four and one third degrees of longitude per day; but if this date be for the afternoon of 30th in *sea reckoning*, 29th in civil time, then the rate is about four degrees per day.* From the meridian of Havanna, lon. 82° 20′, to the place of the *Rover* at 2 P. M. of Sept. 6th, near lon. 90° 27′, the storm was about two days in its progress, which also shows an advance of four degrees per day.

This rate of progression would bring the storm to Soto de la Marina, in lon. 98° 10′, on the 8th of Sept., which is the date given above for its appearance at Victoria in lon. 102°, where it should arrive on the 9th, according to the above rate of advance. Still there can be little or no doubt that the storm of both Soto de la Marina and Victoria was identical with that which was passing through the Gulf of Mexico on the 5th, 6th, and 7th; and we must leave it to Mr. JOLLY or the Baron KARWINSKY to reconcile or explain the dates, as they appear in the Bermuda Gazette.

Course of the Storm and Route of its Vortical Axis.

The course pursued by this storm, as deduced from the foregoing reports, was nearly due west; and the route of its vortical axis, at least from the Bahamas, must have been between 23° 30′ and 24° north lat.; being nearly parallel and coincident with the tropic of Cancer. The axis appears to have been nearer to the

* The daily sea reckoning is made up at noon, commencing from noon of the preceding day; and the absurd custom still prevails of affixing to the afternoon, or first twelve hours of the reckoning, the date of the succeeding day. This useless and perplexing practice has, for many years, been excluded from the English navy, but I am sorry to find that it is still continued in our own naval service. Many intelligent masters in our merchant service have abandoned it. To attain fully this desirable end nothing more is necessary than to affix their true dates to each of the twelve-hour tables of the logbook.

In this article, to avoid confusion of dates, care has been taken to reduce the several nautical dates to civil time, in all cases where it has been practicable.

tropic when off the point of Florida and in Mexico, than when off the Campeche Bank in lon. 90°.

On the north coast of Cuba we find two vessels, the *Rapid* and *Hilah*, which had the first part of the gale from the northward and then shifting suddenly to the southern quarter and blowing with like violence, which shows them to have been near the line pursued by the axis of the gale. At Soto de la Marina on the coast of Mexico and at Victoria in the interior, we find the gale blowing first from the north, then a short *lull*, such as appears to mark the axis in all great hurricanes, and then the recurrence of the blast in full violence from the south as the gale advanced; which fixes the course of the axis at or near these points, and shows, also, the rotative character of the gale.*

It is well to bear in mind the direction of these successive winds, as not being first from the west and then from the east, parallel to the route of the storm, but on the contrary, *crossing*, in succession the path of its axis.

Hourly Progress, and Prolonged Duration with Vessels moving Westward.

We have seen that the rate of progression in this hurricane was about four degrees of longitude per day; which, if we estimate the degree on the parallel pursued by its axis at 63·2237 statute miles, shows an advance but little exceeding ten and a half miles per hour. This will fully account for the increased duration of the gale with those vessels which were running or drifting westward while exposed to its violence.—See cases 22 *b*, 24 *a*, 25, and 32.

Vorticular Character of the Gale.

The continuance of violent easterly winds in this gale on the northern side of its axis, the simultaneous presence of violent and accordant winds from northern points of the horizon in the front side of the gale, the westward veering of the northwesterly winds on the southern side of the storm's axis, and the further sweeping of the winds across the center path of the storm, in the rear side of the gale, from southern points of the horizon,—all go to sustain the conclusion that it was one vast whirlwind, blowing around a vortical axis, which advanced with the storm.†

* This unfailing "*experimentum crucis*" of the character of storms appears to have been sufficiently obvious from the time of the first inquiries on their rotatory action.

† Had the violent winds which were exhibited in the front portion of this gale been found blowing from the west, in the more central portions of its path, and had the later

Strength and Extension of the Trade or Northeasterly Wind on the Northern Side of the Storm.

It has been seen that along an extensive portion of its path and on its northern side, this storm was preceded and attended by a strong northeasterly wind, which appears to have coincided with the right front of the stormy vortex and to have extended as far northward as the Carolinas. This coincident wind, pressing upon the northern border and right front of the hurricane, may have contributed to the vortica extent and activity of this portion of the storm, and doubtless had no small influence in producing its unusually western course.

Eccentrical Position of the Vortical Axis in the Storm.

The greater extent of the gale on the right or northern side of its axis of revolution, or axis route, as compared with its extent on the left side of the axis line, constitutes a remarkable feature in this storm. One probable, if not principal cause of this unequal extension has just been noticed.

This extension of the sensible effects of the storm on the right of its axis path, conforms very strikingly to the effects which have been observed in the paths of small and destructive whirlwinds or tornadoes. This is shown in the case of the tornado which visited New Brunswick, N. J., in June, 1835,* and in that which passed near Providence, R. I., in August, 1838;† and these agree with other observed cases which have not been published. This characteristic has pertained, likewise, to other great storms; owing, probably, to causes which differ somewhat from those which produce the like effect in smaller whirlwinds. But this peculiarity in great storms appears not so common and so strongly marked as in the tornadoes.

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winds of the storm blown along the path of its axis from the east and with still greater force, or had two set of winds, from opposite sides of a central or axial east and west line, blown severally and simultaneously towards that line or some point on the same, in direct opposition to each other, and each set been found limited to its own side of the axis line, instead of blowing *in succession across extensive portions of the same path*, then might it have been claimed that the winds from all sides of the storm blew towards a central point or line, in the body of the storm. But the facts which have been observed appear to forbid such a supposition; not only as relates to this storm, but also as regards every other American tempest which has been duly examined.

* See this Journal for 1841, Vol. XLI, pp. 73, 79, with diagram of survey.

† This Journal for 1842, Vol. XLII, pp. 269 to 278.

Absence of a Brisk Trade Wind on the Southern Margin of the Storm.

We may infer from the reports of the Brig *Rolla* and H. M. Ships *Pilot* and *Ringdove*, that calms and light winds prevailed in the Caribbean Sea and on the southern margin of the storm during the observed progress of the latter. The usual prevailing course or tendency of the lower currents of air, in these regions, at least in the hurricane months, *appears to be from a point south of east*, instead of north of east, as is often supposed.* This general tendency towards some point which is north of west must usually control the courses of the storms in this region. But the lightness of the surface winds of the Caribbean Sea at this period,

* I have ascertained, long since, from logbooks, published journals and nautical directories, that the course of the trade-winds, at their inferior surface, is often parallel to and even one point or more *from* the equator; particularly inside the tropics. From the reported courses of the lower clouds and squalls, by intelligent voyagers and residents in the West Indies, I have also learned, that the course of the lower cloud currents is often, if not generally from southeastward, at least during the northern summer: while the observed courses of the West India hurricanes has demonstrated the northwesterly tendency or courses of of the lower currents, viewed as a whole, in these regions.

Mr. LAWSON, in JAMESON'S Edinburgh Phil. Journal, for July, 1845, has given the results of his observations both on the surface winds and cloud currents at Barbadoes, lat. 13° 10′ N., in 1841; from which it appears that from May to September inclusive, the observations on the surface winds, made at regular periods, have resulted, numerically, as follows: viz. N. W. winds, 3; N., 2; N. N. E., 4; N. E., 13; E. N. E., 106; E., 122; E. S. E., 66; S. E., 41; S. S. E., 13; S., 1; S. W., 2: the E. N. E. being the most frequent wind north of east, while the S. E. and S. S. E. winds greatly predominate over those from N. E. and N. N. E.

His observations on the cloud currents are still more interesting and important. Complete tables of these are given for September and October, which may be taken for nearly average months, as between summer and winter. Two or more currents commonly appeared, above the surface wind; a lower current from south of east and a higher one from S. W.; *both* of which, as well as all *cloud currents* in non-mountainous regions, should be viewed as pertaining solely to the lower atmosphere. The numerical results for the two months were as follows: viz.

Abstract of Observations of the Surface Winds and Cloud Currents at Barbadoes, in September and October, 1841. (Observations taken at 5 A. M.; 10 A. M.; 3 P. M., and 9 P. M.)

From what direction.	Winds.	Cloud currents.	Totals.	From what direction.	Winds.	Cloud currents.	Totals.
W. N. W.		1	1	E. S. E.	21	8	29
N. W.		5	5	S. E.	29	26	55
N. N. W.	1	16	17	S. S. E.	4	31	35
N.	1	18	19	S.	3	11	14
N. N. E.	5	4	9	S. S. W.	1	6	7
N. E.	12	9	21	S. W.		89	89
E. N. E.	90	16	106	W. S. W.	1	6	7
Northeasterly & northerly obs.	109	69	178	*Southeasterly & southerly obs.*	59	177	236
	East obs.		30		15	45	

These, with a vast extension of similar phenomena, merit the serious attention of those naturalists who rest on the calorific theory of the general and trade winds; and they seem fully to account for the northwesterly courses of storms in the West Indies.

when viewed in connection with the strong trade or northeasterly wind which we have noticed as then existing in more northern parallels of latitude, may be deemed sufficient to account for the unusual west course of this hurricane.

The hurricane of August and September, 1842, which has now been considered, caused great injury to commerce and the total loss of many vessels with their crews.

What is meant by Rotary or Vortical Action in Storms.

When in 1830 I first attempted to establish by direct evidence the rotative character of gales or tempests, I had only to encounter the then prevailing idea of a general rectilinear movement in these winds. Hence I have deemed it sufficient to describe the rotation in general terms, not doubting that on different sides of a rotary storm, as in common rains or sluggish storms, might be found any course of wind, from the rotative to the rectilinear, together with varying conditions as regards clouds and rain.

But I have never been able to conceive, that the wind in violent storms moves only in *circles*. On the contrary, a vortical movement, approaching to that which may be seen in all lesser vortices, aerial or aqueous, appears to be an essential element of their violent and long continued action, of their increased energy towards the center or axis, and of the accompanying rain. In conformity with this view, the storm figure on my chart of the storm of 1830* was directed to be engraved in spiral or involute lines, but this point was yielded for the convenience of the engraver. Some indication of the character of a great vortical movement is found in the arrows of the storm figures on my chart of 1835, on tracks I, V, and VII.† In Vol. xxxv, pp. 203–205, of this Journal, and Vol. xlii, p. 114, I have noticed, cursorily, the variable as well as vortical conditions which pertain to great storms. Some of the effects of vortical rotation are also discussed in my account of the Providence tornado.‡

The common idea of rotation in circles, however, is sufficiently correct for practical purposes and for the construction of diagrams, whether for the use of mariners or for determining be-

* This Journal, Vol. xx. The dotted part of this figure was intended to indicate the area of rain.

† See also the storm figures in this Journal, Vol. xxxi, p. 117, and Vol. xxxv, p. 214.

‡ Vol. xliii, p. 271—275.

tween a general rectilinear wind, on one hand, or the lately alleged centripetal winds, on the other. The *degree* of vorticular inclination in violent storms must be subject, locally, to great variations; but it is not probable that, on an average of the different sides, it ever comes near to forty five degrees from the tangent of a circle,—and that such average inclination ever exceeds two points of the compass, may well be doubted.

Second Hurricane of September, 1842.

Between the 18th and 22d of September another storm of violent character crossed the Gulf of Mexico, probably in a northeasterly direction and at a slow rate of progress; but I have not sufficient means for tracing its further advance with much accuracy. This storm also occasioned much injury to the vessels which were exposed to its violence.

Rate of Progression in Storms observed only in the Tropical and Lower Latitudes.

In the following table I have presented some of the principal facts relating to the progress of four several storms of the American seas, the courses of which have been observed only in the lower latitudes. I have also added to this table a storm of the Bengal Sea and Indian Ocean, described by Mr. PIDDINGTON in his Eighth Memoir on the Law of Storms in India. This storm is also distinguished as having moved nearly to the west, but in much lower latitudes than the *Antje's* hurricane.

No. of the track on Chart I.	Date of Storm.	Approximate course of the storm.	Approximate latitude of known route.	Direction of the vorticular rotation in the storm.	Length of known route, in statute miles.	Average rate of advance per hour.
I.	June 23d—27th, 1831.	N. 74° w.	14° 30′ N.	Right to Left.	1900 miles.	18·5 miles.
II.	Aug. 10th—17th, 1831.	N. 64° w.	20° 30′ N.	" "	2160 "	14·4 "
V.	Aug. 12th—18th, 1835.	N. 73° w.	21° 45′ N.	" "	2430 "	16·5 "
XII.	Aug. 30th—Sept. 9th, 1842.	w.	23° 45′ N.	" "	3650 "	10·5 "
	Oct. 22d—Nov. 1st, 1842.	w.	12° N.	" "	2100 "	9 "

The average progression of the four American storms of this table somewhat exceeds fifteen miles an hour. It will be seen that the East Indian storm advanced only at the rate of nine miles per hour, which is one of the slowest rates yet observed, and is much below the average rate of progression of storms in the Asiatic

seas.* Perhaps the tardy progression in this case was owing to the proximity of the storm to the equatorial region and to a sluggish state of the aerial currents then prevailing on its track.

These five storms may be viewed as belonging to one group in the great system of storm paths; a system which appears to me as resulting *directly* from the dynamical influence of the diurnal and orbital revolutions of our planet.

Gales distinguished as Northers, in the Seas of Mexico and Central America.

The term *Northers* may well be applied locally to such storms as the first four comprised in the above table, which passed westwardly through the Mexican sea; for their vorticular rotation being in the direction from right to left, thus, ↻, they necessarily, on arriving near the coast, commenced to blow from some northern point of the horizon.

But the term is most frequently and technically applied to the numerous gales which visit the seas of Mexico and Central America from September to April, and which are almost unknown among the islands of the Antilles or West Indies. Two of these Northers, of much interest, will next claim our attention.

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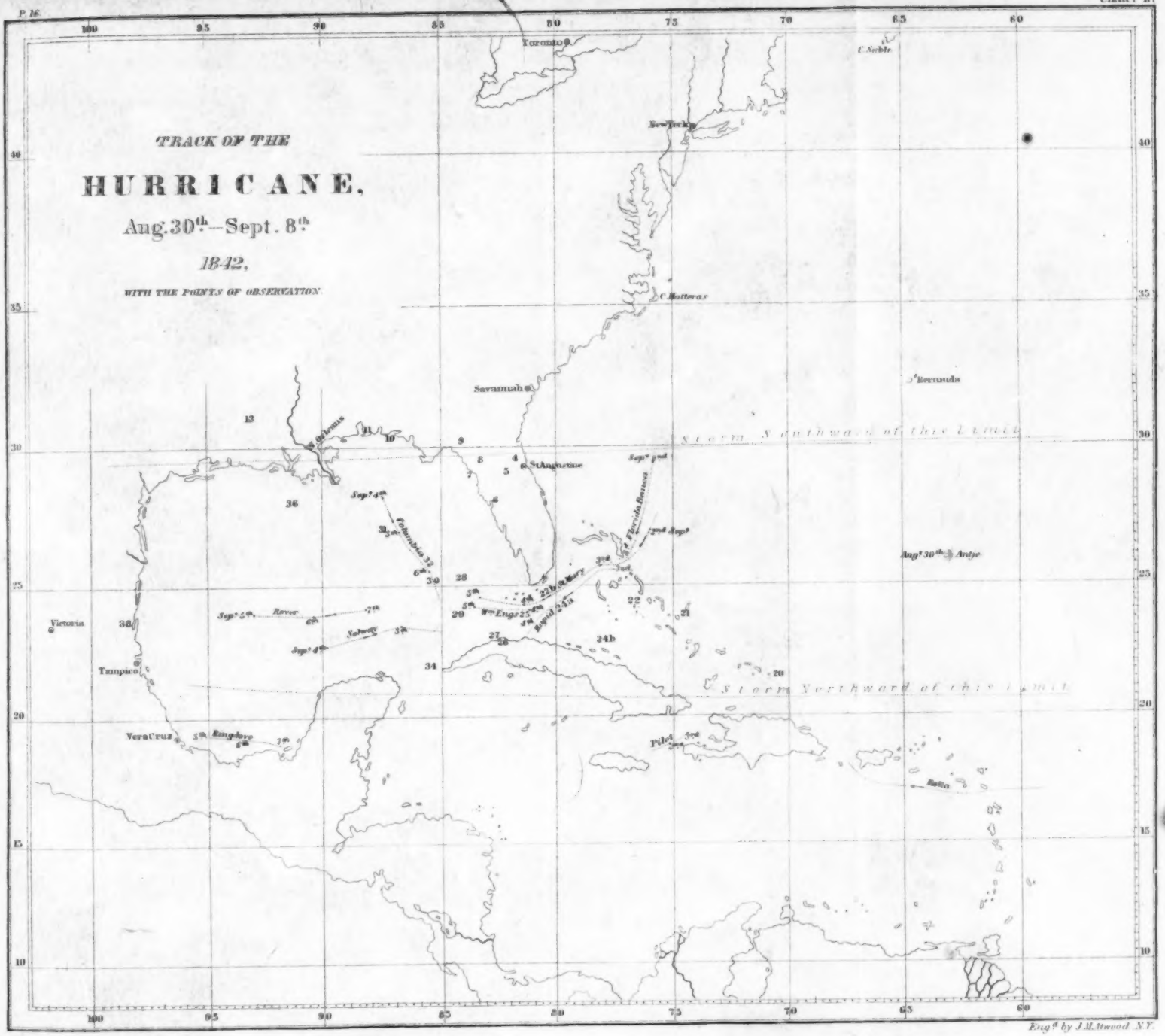
* Mr. THOM computes the diurnal progression of the Rodriguez hurricane of April, 1843, in the South Indian Ocean, at about 220 or 230 miles, or between nine and ten miles an hour, during its early stages in the lower latitudes; and that it gradually diminished till, when near the tropic, it scarcely exceeded fifty miles per day.

Mr. THOM appears to think that the hurricanes of that region probably break up and disappear near the southern margin of the southeast trade wind. This view I cannot reconcile with previous observations in the two hemispheres. A wider scope of observation than was had in the Rodriguez storm would probably show that these hurricanes turn eastward in their course, after crossing the tropic, and that they are identical with some of the violent gales which China ships fall in with while running eastward in the Southern Ocean, between 36° and 40° of south latitude.

The Rodriguez hurricane may have commenced its *easterly* course soon after crossing the tropic; and its slow rate in this region I ascribe, chiefly, if not wholly, to the gradual cessation of its westerly progression.

I apprehend that to a like change in the winds from a westerly to an easterly progression, and *vice versa*, is also to be ascribed, mainly, the several parallel belts of calms and variables which are found on the exterior borders of the trade winds, between the trades and the monsoon winds, and on the equator. Such a system of changes in the great winds of the globe, in the regions referred to, I deem may be fully established by a proper analysis of existing authorities and observations.


TRACK OF THE
HURRICANE.
Aug. 30th—Sept. 8th
1842,
WITH THE POINTS OF OBSERVATION.
Toronto
C. Sable
New York
C. Hatteras
Savannah
Bermuda
St Augustine
Storm Southward of this Limit
Sept 4th
Columbia 32
Sept 2nd
Florida Reefs
2nd Sept
Aug 30th Antje
Victoria
Sept 5th Rover
Sept 6th Sobrero
Sept 4th
Tampico
Wm Engs
Rapid 34
Storm Northward of this Limit
Vera Cruz
Ringdove
Pilot
Bella
Engd by J.M.Atwood N.Y.

Art. II.—*Contributions toward a History of Entomology in the United States;* by John G. Morris, D. D., Baltimore.

(Read before the National Institute, April meeting, 1844.)

Entomology is of all branches of natural history the least cultivated by scientific gentlemen in our country. In Europe, especially on the continent, no department of zoology is more industriously pursued, and none has called forth more numerous or more splendid illustrated works. The science is taught in the gymnasia and universities, collections of insects systematically arranged are found in most of the literary institutions, and are properly considered an essential part of a museum of natural history.

In our own country, the subject has been totally neglected, except by a few, but they have accomplished much, and have rendered invaluable service to the science. They have smoothed the path for their successors, who, it is hoped, will diligently walk in it.

The reasons for this neglect of the science in our country, may be found in the presumed greater economical importance of other branches of natural history; in the diminutive size of insects, often requiring microscopic observation to determine their generic and specific character; in the unfounded apprehension of their poisonous qualities, so common even among educated persons, many of whom have a horror of every thing called a *bug;* in the fatigue and exposure endured in their capture; in the want of entomological books; and in the morbid sensitiveness on the subject of impaling them on a pin. But all these objections vanish on the slightest acquaintance with the subject; and it is presumed that no one ever began the study of it, who was not allured by its powerful attractions to prosecute it to some extent. The field is still very inviting in this country, for thousands of species still remain undescribed—in every excursion the industrious collector captures something new.

Other departments of natural history have been so thoroughly explored as to leave little room for new discoveries or improvements. A new North American bird would be literally a "*rara avis;*" a new mammal would be deemed extraordinary; and a new fresh-water fish would verily be a *queer* one. Indeed, it

may well be a ground of exultation that our naturalists have done so much to illustrate the Fauna of our country. The works of some of them exceed in magnificence and pictorial execution those of any other country, and the literary portions will compare with the most finished scientific compositions of the world. Our mammals have in part been described and figured by GODMAN, HARLAN, BACHMAN, DEKAY, SAY, and ORD, and another splendid work on this order is in preparation by AUDUBON and BACHMAN. Our birds have been represented almost to the life by WILSON, BONAPARTE, AUDUBON, ORD, NUTTALL, BACHMAN, TOWNSEND, and the two BAIRDS. Our reptiles have been described and figured by GREEN, LECONTE, SAY, HARLAN, LESUEUR, and HOLBROOK; our fishes by MITCHILL, LESUEUR, STORER, DEKAY, SMITH, RAFINESQUE, KIRTLAND, AYRES, and HALDEMAN; our shells by SAY, RAFINESQUE, CONRAD, LEA, GOULD, BINNEY, HILDRETH, BARNES, HALDEMAN, ADAMS, and MIGHLES; our crustacea by SAY, GOULD, and HALDEMAN, (the fresh-water microscopian species, especially by the latter.) All these orders have been industriously studied, and he who desires to pursue them still further, has been furnished with books by these accomplished naturalists that will be indispensable.

Entomology has had the fewest cultivators, but still, as was before observed, much has been done. It is my design to give a brief history of the science in the United States, as far as the facts could be ascertained.

The father of American entomology is the Rev. F. V. MELSHEIMER, a Lutheran clergyman who resided in Hanover, York Co., Pa. He was a German by birth, and came to this country in 1777 as chaplain to the Brunswick troops. He was taken prisoner by the Americans at the defeat of Burgoyne, and like many of his countrymen in that expedition, he preferred remaining in the land of his captors to returning to Europe. After performing ministerial functions in several towns of Pennsylvania, he removed to Hanover, where he commenced his entomological pursuits, more than fifty years ago. Some of his first collections are still in the possession of his son. He soon after began an entomological correspondence and exchange with his countryman, Prof. KNOCH of Brunswick, which continued without interruption to within a year of his death in 1810. He published no entomological work except his celebrated catalogue of the

Coleoptera of Pennsylvania, which is quoted as authority by every writer on our insects. His manuscripts are numerous, the principal of which is a definition of the species enumerated in the catalogue, and of about six hundred other species not noticed in it. He wrote a work on mineralogy and a journal of a tour in Pennsylvania, which were published in Germany, besides several books on controversial divinity which were printed in this country. At his death, his collection and manuscripts passed into the hands of his son, the Rev. JOHN MELSHEIMER, who also succeeded to the pastoral care of his father's church. This is the gentleman so frequently mentioned by SAY in his writings. He contributed considerably to the promotion of the science by adding many new species to the collection, and furnishing SAY with such as he wanted, and his observations on them. At his death in 1829, the original collection, the books and manuscripts of father and son, became the property of another son, Dr. F. E. MELSHEIMER, now residing near Dover, York Co., Pa. This gentleman is a most industrious prosecutor of the science, and must be considered one of the best entomologists of the country. His nice discrimination and laborious research have shed much light on the subject; he has cleared away many difficulties—he has discovered the habits of many known, and determined the specific character of many unknown species. He has described more than six hundred new species of *Coleoptera*, which are now in the course of publication in the Proceedings of the Academy of Natural Sciences at Philadelphia. His manuscripts on our *Lepidoptera*, particularly the *Noctuidæ*, are voluminous, which it is hoped will also be eventually published.

The late Prof. WM. D. PECK of Cambridge, Mass., was perhaps the next person after the elder MELSHEIMER, who paid any considerable attention to the subject. He described various species which are injurious to vegetation, in "The Massachusetts Agricultural Repository and Journal." He seemed to confine his attention chiefly to the economical department of the science. His writings contributed much to enlighten agriculturists on this branch of their profession; for their forest and fruit trees, their garden vegetables, grains and other products, are often subject to the ravages of insects whose nature and habits they do not know, and of course, they are ignorant of the best methods of destroying them. As far as could be ascertained, the following are the titles

of his papers. 1. Natural history of the slug worm, (*Blennocampa Cerasi.*) Bost. 1799. 8vo, pp. 14, with a plate. 2. A history of the pine weevil, (*Rhynchænus Strobi,*) with a figure of the insect. 3. A history of the pear tree *Scolytus*, (*S. Pyri,*) with a figure. 4. A history of the oak pruner, (*Elaphidion putator,*) with a plate. 5. The natural history of the canker worm, (*Phalæna* (*anisopteryx*) *vernata,*) the larva of a moth, which in New England is injurious to the apple and elm trees.* 6. A description of the Cossus of the locust tree, (*Cossus Robiniæ.*) This gentleman may have written other papers, but they are unknown to me. They were published in agricultural journals which had not a wide circulation out of New England, and difficult, perhaps impossible, to be procured at the present time.

The first illustrated work on American insects that ever appeared, is *The Natural History of the rarer Lepidopterous Insects of Georgia, collected from the drawings and observations of* Mr. John Abbot. This splendid work appeared in London in 1797, in two large folios, and was edited by Sir James E. Smith. There are but few copies in this country, one of which is in the library of Congress. It contains figures and short descriptions of one hundred and three of our Lepidopterous insects. Swainson pronounces it "to be one of the most beautiful and most valuable illustrated publications that England or any other country can boast of. The plates are the last and best of Moses Harris's performances." Abbot sent many other figures of the same order of insects to London, but they have never been published.

Catesby's great work on the natural history of Carolina, Florida, and the Bahama Isles, appeared some years before Abbot's, but as a small portion of it only is devoted to entomology, it scarcely belongs to our department. There are but twenty four insects figured and described in the two immense folios.

The next laborer in this inviting and interesting field, is the celebrated Say. He has acquired an undying fame by his indefatigable industry and enthusiastic devotion to this pursuit—by his extensive travels in our country in its prosecution—by his numerous writings and his extensive correspondence with foreign

* The larva which commits such ravages on the foliage of the elm in the South is not the canker worm of Prof. Peck. It is the larva of a beetle unknown in New England, (*Galeruca Calmariensis,*) and identical with that of Europe, whence it has been imported.

entomologists. Various scientific journals of our country are enriched with his papers on this and various other branches of natural history. He furnished fifty four contributions for the journals, besides three 8vo volumes on entomology exclusively. Besides insects, he described numerous fresh-water, marine, and land shells, crustacea, arachnides, reptiles, several species of mammals, radiata, zoophytes, annulosa, myriopoda, and entozoa. He wrote also a valuable paper on fossil geology, but his principal and favorite study was entomology. He described eleven hundred and fifty *Coleoptera*, two hundred and twenty five *Diptera*, one hundred *Hemiptera*, and one hundred species of other orders. He established several new genera, made many valuable observations on those already recognized, and numerous interesting and curious remarks on the habits and transformations of insects.

It is to be regretted that his papers are scattered through a variety of publications, from the Transactions of the American Philosophical Society, through KEATING's Narrative of LONG's Expedition, down to a village newspaper, so that it is impossible for the student to procure them all, and some of them are irrecoverably lost. A proposal was issued by M. GORY of Paris, a few years ago, to collect them all and translate them into French, but it is believed the work was suspended after the publication of four thin *livraisons.*

I have thought it well to give the titles of his papers on insects and the work in which they are published. It may be of benefit to those who desire to consult them or possibly to collect them.

1. Description of several new species of North American insects.—Jour. Acad. Nat. Sciences, Phila., Vol. I, p. 19, 1817.

2. Some account of the insect known by the name of the Hessian fly, and of a parasite insect that feeds on it.—Jour. Acad., Vol. I, p. 45.

3. Monograph of the North American insects of the genus *Cicindela.*—Amer. Phil. Soc. Trans., New Series, Vol. I, p. 401, 1818.

4. Description of the *Thysanoura* of the United States.—Jour. Acad., Vol. II, p. 11, 1821.

5. On the South American species of *Oestrus*, which infests the human body.—Jour. Acad., Vol. II. p. 353, 1822.

6. Descriptions of insects of the families *Carabici* and *Hydrocanthari* inhabiting North America.—Am. Phil. Soc. Trans., New Series, Vol. II, p. 1.

7. Descriptions of some new species of *Hymenopterous* insects, collected during the expedition to the Rocky Mountains, under the command of Maj. LONG in 1819–20.—Western Quarterly Reporter, Vol. II, No. 1.

8. Descriptions of insects belonging to the order *Neuroptera*, collected by the expedition under the command of Maj. LONG.—Western Quarterly Reporter, Vol. II, p. 160.

9. Descriptions of *Dipterous* insects of the United States.—Jour. Acad., Vol. III, p. 9, 1823.

10. Descriptions of *Coleopterous* insects collected in the expedition to the Rocky Mountains.—Jour. Acad., Vol. III, p. 139, Vol. IV, p. 83.

11. Account of the insect (*Ægeria exitiosa*) so injurious to the peach tree.—Jour. Acad., Vol. III, p. 216, 1823.

12. The appendix to KEATING's narrative of an expedition to the source of St. Peter's river, contains descriptions of insects by SAY, Vol. II, 1824, 8vo, Phil.

13. American Entomology. 3 vols. royal 8vo, 1817–28.

14. Descriptions of new American species of the genera *Buprestis*, *Trachys*, and *Elater*.—Annals of the Lyceum of New York, Vol. I, p. 249, 1825.

15. Descriptions of new *Hemipterous* (and *Orthopterous*) insects, collected in the expedition to the Rocky Mountains.—Jour. Acad., Vol. IV, p. 307.

16. Descriptions of new species of *Hister* and *Hololepta* inhabiting the United States.—Jour. Acad., Vol. V, p. 32, 1825.

17. Descriptions of new species of *Coleopterous* insects inhabiting the United States.—Jour. Acad., Vol. V, p. 160, 1825–6.

18. Note on LECONTE's *Coleopterous* insects of North America.

19. Descriptions of new species of *Hymenoptera* of the United States.—Two papers published in a periodical entitled "Contributions to the Maclurean Lyceum of Philadelphia," 1827–28.

20. Descriptions of North American *Dipterous* insects.—Jour. Acad., Vol. VI., part 1., p. 149, Vol. VI, part 2, p. 183, 1829–30.

21. Correspondence relative to the insect that destroys the cotton plant.—New Harmony Disseminator, 1830.

22. Descriptions of North American insects, and observations on some already described.

This paper was printed at New Harmony, forming an 8vo volume of 81 pages. Part of it was reprinted in Amer. Phil. Soc. Trans., Vol. IV, New Series.

23. Descriptions of new species of *Curculionites* of North America, with observations on some of the species already known. 8vo, pp. 30. New Harmony, Indiana, 1831.

24. Descriptions of new species of the *Heteropterous Hemiptera* of the United States.—8vo, pp. 39. New Harmony, 1831.

25. New species of North American insects, found by JOSEPH BARABINO, chiefly in Louisiana.—8vo, pp. 16. New Harmony, 1832.

26. Descriptions of new North American *Hemipterous* insects, belonging to the first family of the section *Homoptera* of LATREILLE.—Jour. Acad., Vol. VI, p. 235, 1830–31.

27. Descriptions of new North American *Coleopterous* insects, with observations on some already described.—Boston Jour. of Nat. Hist., Vol. I, p. 2, 1835.

28. Descriptions of new species of North American *Hymenoptera* and observations on some already described.—Boston Jour. Nat. Hist., Vol. I, No. 3, 1836, No. 4, 1837.

29. Descriptions of new North American *Neuropterous* insects and observations on others already described.*

SAY's most costly, though not most valuable work, is the American Entomology, in three fine 8vo volumes. It contains the figures and descriptions of one hundred and thirty two insects of various orders, but unhappily, more regard seems to have been paid to the typographical beauty and external decoration of the work than was necessary, for its consequent high price prevented its general circulation.

SAY died in the full vigor of manhood, (aged 46.) If his valuable life had been spared a few years longer, our science would have reached a lofty eminence through his untiring zeal and persevering energy.

He was one of the original founders of that distinguished institution, the Academy of Natural Sciences of Philadelphia, and for thirteen years was one of its most industrious members and voluminous contributors to its invaluable journal. He rendered distinguished service to the Academy in every respect, but especially in the commencement, in describing, classifying, arrang-

* For this list of SAY's entomological writings I am indebted to the Magazine of Natural History, New Series, Vol. III, p. 139, (London,) to which it was contributed by Mr. DOUBLEDAY.

ing, and cataloguing its collections. The institution, in fact, was in a great degree the work of his hands.

Maj. LECONTE's labors in this field properly belong to this period. This eminent naturalist has never published much on the subject, but his services have been invaluable. There is one paper from his pen, describing some southern Coleoptera, in the Annals of the New York Lyceum of 1824, and a monograph of the family *Histeridæ* with outline figures, in the Boston Academy's Journal of 1845. He contributed largely to that splendid foreign work, BOISDUVAL et LECONTE *Histoire Generale des Lépidoptères de l'Amerique septentrionale*, and I presume furnished most of the specimens and drawings with observations on the larvæ and their transformations. His son, JOHN LECONTE, Jr., is an industrious young entomologist, who bids fair to become eminent in the science.

The entomologist next claiming our attention in the order of time is Dr. THADDEUS W. HARRIS of Harvard University. For many years he has contributed much to the advancement of the science by his valuable papers in the journals. His published writings, as far as they have fallen under my notice, are: 1. A catalogue of the insects of Massachusetts, appended to Prof. HITCHCOCK's Report on the Geology of that state, 1835. 2. A description of some Coleopterous insects, in the Transactions of the Natural History Society of Hartford. 3. A prize essay on the noxious insects of the genus *Melolontha*, in the Massachusetts Agricultural Repository and Journal, Vol. X, 1826. 4. A discourse before the Massachusetts Horticultural Society, 1832. 5. A paper on the genus *Hispa*, in the Journal of the Boston Nat. Hist. Soc. 6. Description of *Tettigonia vitis*, in the Encyclopedia Americana, Vol. VIII. 7. The article *Locusta* in the same work. 8. Descriptions of *Coccus*, (bark louse,) in the New England Farmer, 1828. 9. Description of *Pontia oleracea*, Ibid., 1829. 10. A descriptive catalogue of American *Sphingidæ*, Silliman's Journal, Vol. XXXVI. 11. History of *Ægeria exitiosa*, an insect destructive to peach trees.—New England Farmer, Vol. V. 12. Description of *Ægeria Pyri*, Ibid., Vol. XII. 13. Description of *Arctia pseuderminea*, (salt-marsh caterpillar and butterfly,) 1823. 14. Description of *Sirex Columba*, New England Farmer, 1827. 15. Observations on the insects in the barley straw, Ibid., 1830. 16. Observations on wheat insects, Ibid.,

1831. 17. Remarks on *Scarabæus Goliathus* and other African insects allied to it. 18. A paper on the genera *Cremastocheilus*, in Jour. Acad., Phila.

But the most important work of Dr. HARRIS is a treatise on some of the insects of New England which are injurious to vegetation. It is an octavo volume of 459 pages, (Boston, 1841,) and conveys invaluable information to the agriculturist on a subject very little understood among that respectable portion of the community. The beginner in entomology may also derive much important assistance from it. The enlightened state of Massachusetts, I believe, took the lead of other states in appropriating funds for a complete zoological survey of her territory, and this work of Dr. HARRIS's is one of its invaluable fruits. It is to be regretted, however, that it is not illustrated by figures. This would have rendered it much more valuable to the farmer and horticulturist, who, if unacquainted with entomology, do not easily recognize an insect from a bare description, however accurate. The work treats of the insects most injurious to vegetation, and displays most diligent observation and industrious research.

Various other papers on insects have appeared in the journals; several by Prof. HENTZ in the Transactions of the American Philosophical Society and in the Boston Journal; by Dr. GOULD and Mr. RANDALL in the same publication; by Dr. MELSHEIMER in the Journal of the Academy, Phila.; by Rev. Mr. ZIEGLER of York, Pa., and young LECONTE, in the same; by Prof. HALDEMAN, so favorably known by his splendid work on the fresh-water univalve mollusca of our country, and his "Zoological Contributions." This gentleman has completed a full monograph of the family *Longicornia*, which will be published this year in the Trans. of the Am. Phil. Soc. Prof. POTTER, late of Baltimore, published a pamphlet on the *Cicada septendecim*, most of the observations of which were furnished by Dr. GIDEON B. SMITH, of the same city. This gentleman is extending his observations on that remarkable insect, and has collected a large number of interesting facts, especially in relation to its periodical appearance in different sections of the country. Mr. A. HALSEY of New York also published several papers in the journals. An attempt was made some years ago, by Mr. TITIAN R. PEALE of Philadelphia, to publish an illustrated work on our *Lepidoptera*. Several

numbers were issued, but the laudable enterprise failed for want of support.

Kirby, in the Fauna Boreali-Americana, has described and figured a considerable number of our insects. The older writers of Europe, LINNE, FABRICIUS, HERBST, CRAMER, GODART and others, with the moderns, DEJEAN, GERMAR, ERICHSON, BURMEISTER, &c. &c., have included a large number of our species in their works; but still the cultivation of our field may be said to have been just begun, thousands of our insects still remaining undescribed.

In August, 1842, the Entomological Society of Pennsylvania was formed at York, by a few energetic naturalists, who are pursuing the subject with a very commendable zeal. They have already described and published in the Proceedings of Acad. Nat. Sci. of Phil. more than six hundred new species of *Coleoptera*, and many more still remain to be determined. They have prepared a Catalogue of the *Coleoptera* of the United States, which will be of great value to all who study this subject. This institution, though yet in its infancy, will contribute much to the promotion of the science in our country, especially in the discovery of new species. All the active members have been honored by election to membership of various scientific societies at home, and two of them have received diplomas from abroad. The members are in possession of valuable books on the subject of entomology, and their collections of insects are large and constantly increasing.

Not a few gentlemen of taste in our country collect insects merely as objects of beauty, who do not study the science; but they promote it in some degree, for they sometimes capture species entirely unknown to entomologists.

There are not a few foreign collectors in our country, sent out by learned societies or universities. They send home an immense number, many of which are described and published in foreign journals and books. I lately saw a work of the celebrated ERICHSON, of Berlin, in which more than three hundred species of but a single family (*Brachelytra*) of North American *Coleoptera* are described. He of course will have the credit of doing that which should long ago have been done by our *native* naturalists.

The science is taught at several of our colleges. Dr. HARRIS delivers a course of lectures on the subject at Cambridge, Prof. ADAMS at Middlebury, the writer of this article at Pennsylvania

College, Gettysburg, and probably other institutions have made similar provision.

The collections of insects in this country, though not numerous, are in many instances very respectable. Dr. MELSHEIMER's is the richest in native species that I have seen in this country. Dr. HARRIS's is doubtless very extensive. Major LECONTE's must be valuable. Prof. HALDEMAN, in addition to that made by himself, now possesses the collection formerly owned by Prof. HENTZ, containing many of our rarest species. Mr. ZIEGLER's of York, is increasing. My own contains upwards of seven thousand species of native and foreign *Coleoptera*, and a large number of *Lepidoptera*. Mr. PEALE's, of Washington, is large and splendid, consisting chiefly of *Lepidoptera*. He has them arranged geographically, and not systematically, as most other collectors have. Dr. WILKENS of New Jersey, and Mr. WILCOX late of Brooklyn, N. Y. had magnificent collections; but it is not known to the writer whether they still retain them.

There are doubtless other *private* collections in the country, but they have not come within my observation. The *public* collections are not numerous. Several of our colleges are engaged in establishing them, and it is hoped that soon no cabinet of natural history will be considered to be complete, without a well arranged and correctly systematized collection of insects. That of Count CASTELNAU (M. LAPORTE) now deposited in the National Institute, Washington, is the largest and richest in the country. It is gratifying to learn that the Association of Geologists and Naturalists, at their last meeting in New Haven, directed their attention to this subject. A committee was appointed to prepare a Manual of North American *Coleoptera*, and MELSHEIMER, HALDEMAN, and LECONTE, jr., are just the men to whom such a work may be entrusted. We may before long look for something worthy of their distinguished abilities.

This, as far as could be ascertained, is an imperfect sketch of the past and present state of entomology in our country. It will be seen that little, in comparison with other natural sciences, has been accomplished; but it is advancing, and new laborers are entering the field. It is hoped that it will soon occupy the high position which its interest and importance demand.

ART. III.—*Experiments and Observations on the Solar Rays;* by EDWIN C. LEEDOM, M. D., of Plymouth, Montgomery Co., Pennsylvania.

THE difference of heat acquired by a white and a black body, when both are equally exposed to the sun's rays, has long attracted the attention of observers. "If a black and a white glove are worn by the same person in the sun, the hand with the black glove will acquire the greatest degree of heat. Dr. WATSON, the present Bishop of Landaff, covered the bulb of a thermometer with a black coating of Indian ink, and the mercury presently rose 10°. Black clothes heat more and dry sooner in the sun than white clothes."*

The following experiment was performed by FRANKLIN.

"On a winter's day when the ground is covered with snow, take four pieces of woollen cloth of equal dimensions but of different colors, black, blue, brown and white, and lay them on the surface of the snow in the immediate neighborhood of each other. In a few hours the black cloth will have sunk considerably below the surface; the blue almost as much; the brown evidently less; and the white will remain precisely in its former situation."†

Having described upon a piece of black paper, a circle one fifth of an inch in diameter, I condensed the sun's rays with a lens upon the paper, so as just to fill this circle, which quickly produced an emission of smoke accompanied by the odor of burning paper. The rays were then concentrated upon a piece of white and perfectly clean paper, so as just to fill a circle about one twentieth of an inch in diameter; but no discoloration of the paper, emission of smoke, or any thing indicating an approach to combustion, could be observed. Now, it is apparent that the condensation of the rays within the smaller circle, must have been to that within the larger circle, as the area of the latter to that of the former, which, upon computation, will be found to be as 16 : 1.

From these experiments it appears that there is a vast difference between white and black opaque bodies, as regards the ef-

* Greg. Dict. of Arts and Sci., Article Black.

† Webster's Manual Chem. (Henry 105.)

fects of the sun's rays upon them. Philosophers explain this difference, by supposing that white bodies reflect the greater part of the incident rays, and black bodies absorb them all or nearly all. "In black bodies, such as coal, &c. all the rays which enter their substance are absorbed, and hence we see the reason why such bodies are more easily heated and inflamed by the action of the luminous rays."* Sir DAVID BREWSTER here speaks as if the visible rays contribute as much to the increase of heat as the calorific rays, and also, as if both are acted upon by the coal, &c. in the same manner. But it is certain that the coal acts very differently on the former from what it does on the latter. The moment the rays fall on the coal, the white light which enters its substance disappears—it completely escapes the cognizance of the senses; but the caloric exists within the pores of the coal in a free state, and then escapes in a sensible manner.

It was the opinion of Sir ISAAC NEWTON, that the light which passes into the substance of an opaque body, is "variously reflected to and fro within the body till it happens to be stifled and lost." Later philosophers assert that the particles of bodies exercise a specific attraction over the particles of light. "When a portion of light," says the celebrated Sir DAVID BREWSTER, "enters a body and is never again seen, we are entitled to say that it is detained by some power exerted over the light by the particles of the body. That it is attracted by the particles seems extremely probable, and that it enters into combination with them and produces various chemical and physical effects, cannot well be doubted."† Now, as when the sun's rays fall upon coal or any black body, the greater part of the rays enter the substance of the body, as the intromitted white light is never again seen; but as the caloric exists in a free state, there is every reason to believe that the former, but not the latter, enters into combination with the body. The circumstance of the caloric's quickly effecting its escape from the internal parts of the body, by radiation and otherwise, affords positive proof that it is not acted upon by that specific attraction which, in all probability, detains the white light; nevertheless, it must be acted upon slightly by an attractive force of another kind, or else its total discharge from the in-

* Brewster's Opt., chap. XXXIV. † Opt., chap. XXXIV.

ternal parts of the body would be instantaneous, contrary to what is observed to occur.

Since coal and all black opaque bodies appear to have the power of separating the intromitted white light from the caloric, of detaining the former and rendering it latent, and allowing the latter to exist within the pores in a free state, and since white opacity is the reverse of black opacity, it seems rational to infer that the action of white bodies upon light is the reverse of that of black bodies, that their particles attract and detain the caloric, but, having little affinity for the white light, a large proportion of the latter exists within the pores in a free state, and then escapes by radiation.

"Those bodies which possess the power of reflection in the highest degree, such as white metals, chalk and plaster of Paris, never reflect more than one half of the light which falls upon them; and coal reflects from its first surface only one twenty fifth of the white light."* Now, supposing that black paper possesses the same absorptive power as charcoal, and that the rays which pass into the substance of white paper are disposed of in the same manner as those which pass into the substance of black paper, it follows, that a condensation of rays equal to $1\frac{2}{3}\frac{3}{5}$ upon white paper, should produce the same heating effect as a condensation of rays equal to 1 upon black paper. But it has already been shown, that, when the rays are condensed sixteen times as forcibly on white as on black paper, less tendency to combustion is produced in the former than in the latter. How can the disappearance of so much caloric be accounted for, unless it be supposed that the particles of the white paper attract and detain it, in the same manner that those of coal and other black bodies do the intromitted white light?

The opacity of blackness was ascribed by Sir Isaac Newton to an inability in black bodies to reflect light, owing to the extreme smallness of their particles. But it is now well known that black bodies reflect a considerable quantity of light. Coal reflects one twenty fifth of the rays which fall upon it, and other black bodies of greater density appear to reflect a larger quantity than this. Black marble or any dense black body, when highly polished, possesses sufficient reflecting power to form a tolerably

* Brewster's Life of Newton, chap. VII.

good mirror. If a piece of white paper on which the colors of the spectrum are painted, be held before a highly polished black surface and viewed by reflection, the white paper and all the different colors will be distinctly seen. Having procured a piece of anthracite which possessed a smooth, glossy surface, I concentrated the sun's rays with a lens alternately upon the smooth surface of the coal, and a piece of white china of very fine grain and good polish, and threw the reflected rays upon a piece of black paper at a small distance from the focus. The rays which were reflected from the black surface, appeared to act upon the paper as quickly and as forcibly as those reflected from the china; a copious emission of smoke, accompanied with the odor of burning paper, being the result in each case. Pieces of phosphorus also were inflamed as quickly, and apparently at as great a distance, by the rays reflected from the coal, as by those reflected from the china. Indeed, when the two reflecting surfaces were examined by the microscope, the polish of the coal appeared to be inferior to that of the china.

Hence it appears that black bodies possess the power of reflection in a high degree. Black opacity, then, cannot be owing to an inability in the particles of black bodies to reflect the sun's rays. But, since "coal does not transmit to the eye a single ray out of those which enter its substance,"* it must be admitted that the phenomenon of blackness is produced by the absence of free light from the pores of an opaque body.

As white opacity is the reverse of black opacity, and as white bodies appear to detain the greater part of the solar caloric which enters their substance, in the same manner that charcoal and other black bodies do the intromitted white light, there is strong reason to believe, that the white light being but feebly attracted by the particles of white bodies, a large proportion of it exists within such bodies in a free state, and then escapes from their pores by radiation, as caloric does from heated bodies, and that this radiation of free white light from the pores of opaque bodies produces the phenomenon of whiteness. That the existence of free white light within the pores of an opaque body, even coal, would produce whiteness, is admitted by Sir David Brewster himself. In his refutation of that part of the Newtonian theory

* Brewster's Life of Newton, chap. vii.

which ascribes opacity to a multitude of reflections within the internal parts of bodies, he says: "If the particles of light were reflected or merely turned out of their direction by the action of the particles, it seems to be quite demonstrable that a portion of the most opaque matter, such as charcoal, would when exposed to a strong beam of light, become actually phosphorescent during its illumination, or would at least appear white."*

The circumstance of the caloric's existing in a free state in the pores of black bodies, and becoming latent in white bodies, affords a ready explanation of the difference of heat acquired by a white and a black body, when both are equally exposed to the sun's rays. It is free, uncombined caloric which occasions the sensation of heat, causes the mercury to rise in the tube of the thermometer, overcomes the cohesive attraction of the particles of coal, &c. and enables them to combine with oxygen and produce the phenomenon of ordinary combustion.

Philosophers, for a long time, supposed the action of natural bodies upon light to be purely mechanical. Sir Isaac Newton, finding the least parts of many bodies to be in some measure transparent, supposed the colors of all bodies to be produced by their power of reflecting some rays and transmitting others, and their "opacity to arise from a multitude of reflections caused within their internal parts." "The transparent parts of bodies," says that great philosopher, "according to their several sizes, reflect rays of one color, and transmit those of another, on the same ground that thin plates or bubbles do reflect or transmit these rays; and this I take to be the ground of all their colors."†

Sir David Brewster, although he doubts not that the "Newtonian theory is applicable to colors of the wings of insects, the feathers of birds, the scales of fishes, the oxidated films on metal and glass, and certain opalescences, still believes that the colors of vegetable life, and those of various kinds of solids, arise from a specific attraction which the particles of these bodies exercise over the differently colored rays of light." "When," says he, "colored bodies are opaque, so as to exhibit their colors principally by reflection, the light which is reflected back to the observer, has received its color from transmission through part of the

* Brewster's Opt. chap. xvi. † Opt. chap. xxxiv.

thickness of the body, or, what is the same thing, the color reflected to the eye, is complementary to that which has been detained by the particles of the body, while the light is passing and repassing through a thickness terminated by the reflecting surfaces," &c.*

The arguments advanced by this philosopher, in support of the opinion that the particles of bodies exercise a specific attraction over the particles of light, are forcible and convincing; but that part of his theory, which has for its object the determination of the manner in which the colored light is discharged from colored opaque bodies, will not, it appears to me, bear a thorough examination. When he says that "the color reflected to the eye is complementary to that which has been detained by the particles of the body, while the light is passing and repassing through a thickness terminated by the reflecting surfaces," he means, I presume, that the colored light is reflected to the eye from the second surface of a thin transparent stratum, the complementary light having been detained by the particles composing this stratum. According to this theory, the thinnest strata of all colored opaque bodies are transparent. But this is by no means certain. There is reason to believe that the thinnest film which can be formed of any metal is opaque. Gold leaf, it is true, transmits a portion of colored light, but, when it is examined by the solar microscope, it is said that innumerable rents can be perceived within it; wherefore, it is probable that the light which is transmitted passes through openings which have been caused by a forcible separation of the particles. The gold which covers the silver of which gold wire is formed, is vastly thinner than gold leaf. According to the computation of Dr. Halley, the ten thousandth part of a grain of gold covers a piece of wire one eighth of an inch in length, "and yet, though the gold with which such wire is coated is stretched to such a degree, so intimately do its parts cohere, that there is not any appearance of the silver underneath."† Even supposing a colored opaque body, a piece of gold for instance, to be composed of thin transparent strata, still, it is difficult to conceive how there can be any reflection except from the first surface of the gold, unless it be supposed that the layers

* Life of Newton, chap. vii.

† Greg. Dict. of Arts and Sci., Articles Ductility and Wire.

are separated from each other by interstices filled with a medium of less density than the gold itself. As gold is a simple substance, the layers must all be equally refracting media. If the strata be supposed to be closely joined together, without any interstices between them, there certainly can be no reflection at their intervening planes; for, it was established by Sir Isaac Newton as a fundamental principle, that within "the confines of equally refracting media there is no reflection." Indeed, that there is underneath the first surface of gold any other surface which reflects light, appears to me in the highest degree doubtful. Unless I misapprehend the passage quoted on the preceding page from Sir David Brewster, his explanation of the mode in which the colored light is discharged from colored opaque bodies, is based altogether on imaginary data, and must therefore fail to give entire satisfaction to the true inquirer.

When the sun's rays fall upon a piece of anthracite or any dense black opaque body, part of the caloric, as has been already demonstrated, is reflected from the outer surface, and part of it enters the body. A large proportion of that which enters the body exists within it in a free state, and then escapes from its pores by radiation and otherwise. Except as regards their effects upon animal bodies, the one causing the sensation of heat, the other that of vision, the rays of caloric and the rays of color bear the greatest resemblance to each other. They both come from the sun to the earth in the same time; they are both refracted in the same manner by lenses, and reflected by specula; and are equally the produets of ordinary combustion. Now it appears to me, that this analogy gives strong support to the opinion, that a part of the light which enters into the substance of colored opaque bodies, exists within them in a free state, and then escapes from their pores by radiation.

It will be admitted that the outer and inner particles of any simple body possess the same properties. When light falls upon an opaque body, "part of it is reflected or driven back, and part of it enters the body." If, as is maintained by Sir David Brewster, and other eminent modern philosophers, the particles of bodies exercise a specific attraction over the particles of light, the outer particles of any colored, opaque, simple body, must attract and detain the same sort of rays that the inner particles do. The light which is complementary to that which has been detained by the outer particles of the body, must necessarily be driven off

from the outer surface of the body together with the undecomposed white light. Also, it can readily be conceived that that part of the intromitted light, which is complementary to that which has been detained by the inner particles of the body, must exist within the body in a free state, and then effect its escape from the pores, by that self-repellent power of its particles which is known to exist, and is the cause of radiation.

That a part of the colored light which is discharged from any colored opaque body, proceeds from the outer surface of the body, there can be little doubt. Procure an opaque body whose color is one of the primary colors of the spectrum, a piece of gold for instance, possessing a flat surface highly polished. The greater part of the light which is reflected from such a surface, is known to be reflected regularly. Throw the sun's rays obliquely upon the polished surface of the gold, and receive the reflected light upon white paper, which will be tinged of a yellow color. But, the yellow color thus given to the paper by the reflected light, will be very faint in comparison to the color of the gold itself—too faint to admit the belief that all the yellow light which is discharged from the gold proceeds from its outer surface; but no more vivid than can readily be accounted for, by supposing it to be complementary to the light which has been detained by the outer particles of the gold.

The brilliant colors of certain solid bodies, such as chromate of lead, indigo, &c., cannot, I think, be explained unless we call in to the aid of reflection a copious radiation of colored light from the internal parts of these bodies.

To the opinion that part of the light which enters the substance of colored opaque bodies exists within them in a free state, and then escapes from their pores by radiation, as caloric does from heated bodies, it might be objected, that the discharge by the bodies in question of all the light which is not permanently detained by the specific attraction of their particles, is instantaneous, but that a heated body requires some time to part with all its free caloric. But there is no proof that the discharge by the bodies in question, of all their free light, is instantaneous. When the color of a body ceases to make an impression upon the organ of vision, that is no proof that no more visible rays are discharged from the body. The human perceptions are not always unerring guides in tracing the operations of nature. It is well known that a body may feel cool to the touch, and yet, at the same time,

radiate caloric. There is reason to believe that white and colored opaque bodies continue to discharge visible rays some time after they are deprived of all accessions of light from any external source. When there is snow on the ground, its whiteness is perceptible, let the night be ever so dark and cloudy. This opinion is also strengthened by the circumstance of some of the lower animals, owing to a more delicate structure of the eye, being able readily to distinguish objects in what would be total darkness to man. "The pupil admits of greater dilation in the cat, in the owl, in night birds, and in general in all animals that see in the dark. The retina likewise appears more sensitive in those animals; several of them appear incommoded by the light of day, and never pursue their prey but in the most obscure darkness."*

That light, after being absorbed by opaque bodies, can exist within them in a free state, and then escape from their pores by a self-repellent power of its particles, is admitted by Sir DAVID BREWSTER. In the latter part of the eighth chapter of his Life of Newton, in which he advances a new theory of inflection, I find the following passage.

"That the particles of light, like those of heat, are endowed with a repulsive force which prevents them from accumulating when in a state of condensation, or when they are detained by the absorptive action of opaque bodies, will be readily admitted." It appears to me somewhat remarkable, that this important idea was excluded from his "New Theory of Colors."

The proper colors of opaque bodies certainly depend but little upon the light which is reflected from their external surfaces. Let a small piece of black marble which has a flat surface well polished, be held in a particular manner between the eye and a sheet of white paper. Every part of the flat surface of the marble will reflect to the eye a part of the image of the paper, so that the whole of the surface will appear white. Instead of the sheet of paper, substitute a large piece of red cloth, and the surface of the marble will appear red; if yellow cloth be substituted for the red cloth, the surface of the marble will appear yellow, and so on. Now this shows that the native blackness of the marble is owing to no deficiency of reflecting power. But further, coal reflects from its external surface one twenty fifth of the incident light; and a white body, such as chalk, reflects about

* Richerand's Physiology, chap. VII, p. 215.

one half of the light which falls upon it. Let a quantity of white light equal to two, fall upon a piece of chalk, and another quantity of white light equal to twenty five, fall in the same direction on a piece of charcoal of the same size and shape as the chalk, and which has the same position. Under these circumstances the charcoal must reflect as much white light as the chalk. But the coal will still appear black, while the chalk will preserve its whiteness.

The explanation of white and black opacity given by optical writers, must be erroneous; for, the whiteness of chalk is perceptible in a dark, cloudy night, whereas charcoal appears intensely black, even though viewed by the direct light of the sun, when the sky is cloudless and the ground covered with snow.

It is asserted by Sir DAVID BREWSTER, that "coal does not transmit to the eye a single ray out of those which enter its substance." Now, if when an opaque body discharges no light whatever from its internal parts, we have the phenomenon of blackness, even though the quantity of light reflected from its external surface is considerable, it must I think be admitted, that when such a body possesses a proper color, its color is owing to the radiation of colored light from its pores.

In making a brief recapitulation of the views unfolded in this paper, I would say that the particles of all opaque bodies exercise over the intromitted rays a specific attractive power. Those of coal and other black bodies attract and detain the white light, but, having a feeble affinity for the caloric, the latter exists within such bodies in a free state, and then escapes from their pores by radiation and otherwise; the particles of white bodies detain the caloric, but, having less affinity for the white light, a large proportion of the latter exists within these bodies in a free state, and then escapes from their pores by radiation; and the particles of a body whose color is one of the primary colors of the spectrum, attract and detain the light which is complementary to that which gives the body its proper color, the latter, being left free, escapes from the internal parts of the body, by that self-repellent power of its particles which is known to exist, and is the cause of radiation.

This theory is one of extreme simplicity; but it is not for that reason the less likely to be true. We are taught by Sir ISAAC NEWTON, that "Nature does nothing in vain, but is simple, and delights not in superfluous causes of things."

ART. IV.—*Some facts respecting the Geology of Tampa Bay, Florida;* by JOHN H. ALLEN, Principal of Chilicothe Academy, Ohio, and late Lieut. of Artillery in the U. S. Army in Florida.

THE peninsula of Florida presents many interesting geological features; it is evidently of an origin comparatively recent, and its rocks and marl beds are replete with a vast quantity and rich variety of organic remains, which have as yet been but imperfectly examined. This region is not only attractive to the geologist, but to the naturalist in every department. Along the borders of its rivers and in its rich hammock lands, are found a profusion and variety of trees, shrubs and plants, which excite admiration by their magnificence and beauty. It swarms with beautiful insects of every hue; and in the shallow waters of its bays live myriads of shell fish, belonging to a great variety of species.

One of the most interesting points in Florida to the geologist is the neighborhood of Fort Brooke at the head of Tampa Bay. The first layer of solid rock beneath the soil is a stratum of limestone; it is hard and white, has an earthy texture, and appears to have resulted from comminuted and decomposed shells. The surface of this rock is exposed in several places in the vicinity of Fort Brooke, about two miles north, near the Hillsboro' river, four miles west on the shore of the bay, and six or seven miles east in the banks of a small stream. This rock has a very extensive range. I have seen it in many parts of the territory;—in some places it is soft and friable, very much resembling chalk, all traces of organic remains having been obliterated by the decomposition of its material previously to its consolidation. I have noticed it at points more than one hundred and fifty miles distant from each other, presenting the same lithological characters. It constitutes the bottom of the many ponds and lakes in the interior, and I have been informed, that its white and jagged surface can be seen throughout the whole extent of the everglades, that singular sea of fresh water and coarse grass, that covers an area of several thousand square miles in the southern part of the peninsula. This immense volume of fresh water must be forced up through crevices in this rock.

This limestone in some places is destitute of organic remains, in others it contains a great abundance of them, such as univalves, bivalves and echini; where it has been exposed to the disintegrating influences of the atmosphere, beautiful specimens can be detached. It has in many places sunk down and left depressions called *limesinks;* which often have a small area and are several feet in depth, appearing more like artificial wells than natural productions. The loose texture and proximity of this rock to the surface accounts for the fact, that the sandy soil of the country contains a large proportion of lime in its composition and possesses a greater fertility than its aspect promises. I have never seen any chert in the limestone, but from the frequent occurrence of nodules of that mineral on the surface, I should infer that they came from it. This rock must be several feet in thickness, for extensive caverns and galleries are found in it, worn out by subterranean streams; there is a small excavation near Fort Brooke, running many feet horizontally and nearly high enough for a man to stand upright.

There is another rock that probably dips beneath the limestone—a dark bluish, silicious rock, of a compact texture, somewhat vesicular, the vesicles containing minute crystals of quartz. This rock can be seen at the rapids of the Hillsboro', about nine miles north of its mouth. I have noticed bowlders of it at several places in the interior, particularly near the forks of the Withlacoochee river, containing beautiful impressions of bivalve shells. This and the limestone are the only compact rocks I have ever seen in the peninsula. Small bowlders of a gray sandstone occur a few miles north of Fort King.

In the vicinity of the Hillsboro' river and other streams that discharge their waters into Tampa Bay, are several sulphur springs, which issue from crevices in the rocks, and supply a copious quantity of water charged with sulphureted hydrogen gas. There is a very large one near the west bank of Hillsboro' river, about eight miles north of Fort Brooke; it is thirty feet or more in diameter and twelve feet deep, and issues from a crevice in the underlying rock, throwing out sufficient water to form a stream more than twenty feet wide and eighteen inches deep, which bubbles up with so much force as to keep the surface in a constant agitation like the boiling of a large caldron. The waters of this spring are so pellucid that minute fragments of shell glisten on the bottom like pearls, and large turtles with a great variety of fish

are seen swimming about; from the number of fish, I inferred that they are fond of frequenting sulphureted waters. When I visited this spring, the stream flowing from it into the Hillsboro' river was literally crowded with them. These springs are very abundant; there is a small one southwest of the fort, near the western shore of the bay, and a large one about seven miles east; some species of shell fish live in the streams that flow from them. A species of Neritina, that is very abundant in the brackish waters at the head of the bay, seems to have a great predilection for these sulphurous waters, in which the individuals grow to a greater size than they attain elsewhere.

There is a peculiar beauty and placidity in the springs of Florida, embosomed as they are with a perennial foliage, that might well have confirmed the Spanish adventurer Ponce De Leon in the belief that some one of them possessed the power of removing the decrepitude of age, and restoring the freshness and elasticity of youth.

Along the shore of Tampa Bay, the country is low, seldom attaining a height of more than ten feet above the surface of the water; it is generally sandy, but in some places there are beds of marl, which when they form the surface, constitute a rich and fertile soil. These beds differ materially in their composition and organic contents; they evidently belong to different geological periods. One of the most ancient and interesting of these deposits can be seen about two miles west of Fort Brooke, where a section a few hundred feet in length has been exposed by the washing of the waters of the bay. Immediately back from the shore it is covered by three or four feet of loam and sand. This bed consists of blue marly clay, interlaminated with seams of carbonate of lime, which probably has resulted from the decomposition of shells; that which renders this deposit unusually interesting is the remarkably beautiful petrifactions that it contains, and that surpass any thing of the kind I ever saw. Interspersed throughout the marl are masses of silex presenting a great variety of shapes and colors; some have a rough and jagged surface and wine yellow color, some are hollow cylindrical tubes of different colors, straight or bent, from one to six inches in length, and from one fourth of an inch to one inch in diameter, with a fine drusy interior; others are beautifully agatized, having that moss-like appearance that agates sometimes possess; these silicious concretions are both opaque and translucent, and are probably of organic

origin. There are also found in this bed round cylindrical stems, fluted and gradually tapering to a point with a slight curve, they are from three to four inches in length; likewise a species of large radiated coral, shaped like the segment of a sphere, petrified with wine colored silex, and having a mammillary interior of carnelian or chalcedony.* The most beautiful petrifactions of this deposite are various species of shells that are so perfectly petrified with clear wine colored silex, that all their most minute and delicate markings are preserved; so great is their translucency, one can nearly read through them. They appear to have petrified before having suffered the least from attrition or decomposition; the spiral univalves taper to a transparent needle-like point. I found one petrified with carnelian. I obtained more than twenty specimens, among others some of the following genera: *Murex*, *Oliva*, *Cyprea*, *Buccinum*, *Cardita*, *Trochus*, *Cerithium*, *Pura* and *Helix*, a few of which are found living at present in the bay, some are indigenous to the West Indies; they are washed out of the marl and strown along the shore by the constant action of the water. There are other beds of marl, apparently of a much more recent origin, one of which extends along the shore at Fort Brooke; it is an earthy mass containing vast quantities of oysters and other shells, extends a few hundred feet back from the shore, and is several feet in thickness. I have seen dug out of it bones of the *Manatus* or sea cow, an animal that still exists in the southern part of the peninsula.

Deposits of marl, and shell banks, occur at many places on the western coast of Florida. About thirty five miles south of Fort Brooke, near the mouth of the Manatu river, there is an extensive bank of shells ten feet or more in thickness, composed almost wholly of large unbroken univalves, belonging principally to a species of *Pyrula*, without any admixture of earth. I never before saw shells of this kind in such large quantities, and from their volume and position, I should infer that they had been

* These beautiful fossils are well known in mineralogical cabinets as "chalcedony from Tampa Bay." In most of the geodes which we have seen from this locality, the zoophytic structure of the mass could be readily detected. One large hollow spheroidal or pyramidal specimen which we have, has numerous stalactical masses rising inward from its base of the size and length of a man's finger. These have arisen from the perforation of the original animal structure by saxicavous shells who had there taken up their quarters. When the silicifying influence (whatever it was) came on, the silica penetrated evenly all the cavities and inequalities of the original, copying with surprising delicacy, all the minute markings of the zoophyte.—*Eds.*

amassed by the action of violent storms; they are abundant in the bay. All however which I have seen alive are of a smaller size, from which I should judge that the larger ones lived at some remote period, when a warmer climate and other circumstances were highly favorable to the development of molluscous life. I noticed fragments of Indian pottery amongst them; their immense quantity precludes the idea of their having been accumulated by the aborigines of the country.*

This place possesses much interest on account of its being the spot where De Soto landed his army. A short distance from the shell bank, are the remains of ancient fortifications, probably built on this occasion or subsequently by the Spaniards.

There are found along the shore at Fort Brooke, small beautiful fortification agates, which probably are washed out of the marl bed that contains the siliceous petrifactions. Deposites of ochre are found between the head of Tampa Bay and the Gulf of Mexico; and I have noticed near the marl bed, large masses of sand cemented by the oxide of iron.

To the botanist Florida presents a rich field of research; here he can behold in their native beauty and magnificence, a great variety of trees and plants—the lofty Gordonia, the gorgeous Magnolia, that perfumes the atmosphere with its fragrance, and the tall Palmetto, that gives an oriental appearance to the country. The ground in many places is carpeted with the delicate sensitive plant, and upon the trees grow a great variety of parasites, the most conspicuous and showy of which is the *Tillandsia utriculata*, whose long subulate leaves form at their base a depression, out of which rises a stem three feet high, covered with a profusion of white flowers, that produce a fine effect amidst the long moss (*Tillandsia usneoides*) that frequently invests the trees. The Hydrangea and the beautiful coral tree, (*Erythrina*,) are seen in their native luxuriance; and many vines, such as the Bignonia, Passiflora and Ipomea, trailing from trees and shrubs, delight the eye with their splendid flowers. Along the coast the mangrove (*Rhizophora*) forms an almost impenetrable mass of vegetation, by sending down from its branches vertical stems that take root in the soil.

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* It probably requires more investigation and comparison before we can safely say that the shells mentioned by Mr. Allen, are identical with those now living on the coast. It is quite probable that a large proportion of them are so.—*Eds.*

Art. V.—*Review of the New York Geological Reports.*

(Continued from Vol. xlviii, p. 316.)

In continuation of the New York Geological Reports, we proceed with the description of the

Onondaga Salt Group. (Not recognized in the Pennsylvania survey.)—In the geographical subdivisions of the New York System adopted by most of the New York geologists, this group forms the lowest member of the Helderberg series;* in the chronological table, it forms the second member of the middle division in the ascending scale.

As a whole it is an immense mass of argillo-calcareous shaly rocks, enclosing veins and beds of gypsum; hence this has been designated by some as the "gypseous shales." From the lithological character of these beds, their outcrop has suffered much from denudation, and their superficial area occupies a wider district of country than most of the preceding members, especially along the valley of the Clyde,—covered up from view, however, to a great extent, by accumulations of drift. To the east it runs out near Sharon Springs; west it extends into Canada, being coextensive with, and running parallel to the Niagara group, upon which it rests. Its superficial area is represented on the geological chart by a light ochre.

Four divisions have been distinguished in the description of the Onondaga salt group, though the lines of separation are by no means well defined.

1. Red and greenish shale below.

2. Green and red marl, shale and shaly limestone, with some veins of gypsum.

3. Shaly and compact impure limestone, with shale and marl, embracing two ranges of plaster beds, with hopper shaped cavities between.

4. Drab colored impure limestone with fibrous cavities; the "Magnesian deposit" of Vanuxem.

* In Emmons's tabular view of the New York System, the "Onondaga salt and plaster rocks" are placed in the Ontario division. In a *geographical* arrangement this is perhaps the more correct grouping, since these formations are in full force along the valley of Lake Ontario, and are almost absent in the first geological district, where the Helderberg Mountains are situated.

Of these, the third is the only one that has yielded gypsum in profitable quantities. The included masses of gypsum, though, for the most part, even-bedded at their base, are usually very irregular at their upper surface, often conical. The plaster beds are supposed to be segregations by molecular attraction from the marl. Might it not have originated in the introduction of subterranean springs, charged with sulphuric acid or sulphates, bursting up through fissures in the inferior strata, and mingling with the waters of the ocean holding lime in solution, by which mounds and irregular beds of the resulting precipitated sulphate of lime would accumulate, isolated in a great measure from the deposites of calcareous mud going on around? Most of the gypsum is of a dull earthy color, and it usually effervesces with acids from the presence of carbonate of lime.

This third division contains not only the gypseous beds, but is, most probably, the source also of all the salt so extensively manufactured at Onondaga, Cayuga and Madison; at least VANUXEM informs us, that, except in these gypseous beds, there is no evidence of salt existing in the solid state in any of the other divisions of the Onondaga salt group. This author believes that the hopper-shaped cavities situated between the two plaster beds prove that salt has crystallized during the desiccation of the waters in which the surrounding deposite of argillaceous and calcareous matter was going forward, since, during the evaporation of brines, cubes of salt aggregate so as to form groups of crystals corresponding perfectly to such a matrix. Near the same geological position is the *Vermicular lime rock* of EATON, so called from numerous, disseminated, tubular cavities, which VANUXEM thinks are also due to previously existing common salt.

The fourth division is remarkable for a fine columnar structure or needle formed cavities dispersed through the mass. These VANUXEM believes to have been caused by crystallizations of sulphate of magnesia during the consolidation of the rock, and subsequently removed by percolation of water; for this reason he has denominated this part of the Onondaga salt group the "*Magnesian deposite*," and its cavities "*Epsomites*."

Connected with this formation, "between the two porous masses," the geologist of the third district has described "a mass of *altered* rock extending for many rods," which in structure par-

takes, in part, of the character of serpentine, and, in part, that of granite and sienite, whilst some of the adjacent calcareous portions show a crystalline grain with streaks of a light bluish shale. These metamorphic products he conceives were not formed by a "dry heat or fire," but were the result of solution and crystallization from a thermal water.

We would inquire, is there unequivocal evidence that the metamorphic rocks are entirely cut off from all connection with inferior intrusive veins?—because, unless there is, we can perceive no good reason for denying to them an origin which is generally conceded to belong to geological formations of similar structure. A microscopic, crystalline texture is certainly not incompatible with fluidity or semi-fluidity by dry heat. Is it not rather evidence of sudden consolidation?

The thickness of the first division of the Onondaga salt group on Steele's Creek, is estimated at eighty feet, but in Onondaga County its maximum is five hundred feet, unproductive of any valuable mineral. The exact thickness of the other divisions does not appear to have been ascertained, probably for the want of favorable sections. We are informed, however, that a well had been sunk at the Indian Reservation to the south of Vernon Village, eighty feet through strata belonging to the second division; these borings were commenced below the range of the plaster beds. Some of the plaster quarries in the third division have exposed from twenty to sixty feet of strata above the gypsum deposite. In Madison County the upper and lower porous or vermicular limestones are together twenty four feet. In the middle counties the entire thickness of the Onondaga salt group must be from six hundred to a thousand feet.*

Notwithstanding its great thickness, this formation is very barren in fossils. The corals and shells of the Niagara group suddenly ceased to exist, perhaps, as HALL suggests, being overwhelmed by the sudden outbreak of a mud volcano at the bottom of the ocean, by which the waters became surcharged, not only with argillaceous sediment, but became contaminated either with free sulphuric acid, or sulphate of magnesia and soda.

* HALL, at p. 133 of the Report of the Fourth District, speaking of the immense accumulation of mud on the top of the Niagara limestone as caused by a mud volcano, estimates it at a thousand feet.

The only organic remains yet discovered in the group in question, are, the head of a trilobite, *Eurypterus remipes*, and the forms represented beneath.

Hall's Report, p. 137.

Fig. 1. *Cornulites*, n. s. 2. *Orthoceras læve*, H. 3. *Lozonema Boydii*, H. 4. *Euomphalus sulcatus*, H. 5. *Delthyris* ——? 6. *Atrypa* ——? 7. *Avicula triquetra*, H.

"These all occur at a single locality, and but one other shell has been seen in the group."

If any portion of the Onondaga salt group exists in the West, it is but obscurely marked. None of the above fossils have come under our notice in the Western States; but in the Du Buque district of Iowa, and on the opposite side of the Mississippi in Illinois, on section fourteen, township twenty five north, range seven east of the fourth principal meridian, a vermicular lime rock was discovered, answering to the description of the porous beds of the third division of the Onondaga salt group. If this has originated, as has been suggested, in crystallizations of muriate of soda, it cannot be considered much evidence in favor of the identity of the two formations; but the transverse septa and lamelliferous, cellular structure, visible in some specimens from the western formation, leaves little room to doubt *their* organic origin.

The country through which the Onondaga salt group extends, is usually marked by a series of low gravelly hills and clayey valleys, on which a stunted growth of timber prevails, known by the name of "Oak openings."

Small portions of sulphate of strontia, galena and blende, with rhomb spar, occur in the upper portion of the group. Gypsum and salt are, however, the only minerals of economical val-

ue; of the former many thousand tons are annually excavated. Several acidulous springs issuing from these deposites, have been found to contain free sulphuric acid.

Water Lime Group. (A part of No. 6 of the Pennsylvania survey.)—For better distinction known also as the "Manlius water lime," since the terminal division of the last group, according to HALL, assumes, in the region around Cayuga Lake, the character of a water lime, and is employed, like the rock now to be described, as a hydraulic cement.

The Manlius water limestone consists of drab colored layers interstratified in a mass of darker blue limestone. The thickness of the whole varies from thirty to a hundred feet, but only a few feet of this is suitable for hydraulic purposes. The layer most highly esteemed for cement, is from four to five feet thick, of a drab color, and fine grained, traversed by oblique cracks in at least three directions, which causes it to break into irregular fragments. At some localities siliceous nodules are interspersed; then it is no longer fit for a water lime. An interlamination of shale is also destructive of its economical value, since an excess of argillaceous matter is very injurious to such cements.

The individual layers are not unfrequently interlocked by a notched surface not unlike the sutures of a skull; this appearance VANUXEM attributes to crystallizations of sulphate of magnesia.

On the chart, the water lime is represented by a grayish blue band, narrow and rather tortuous in its course, whose general direction is nearly west and east, from Niagara river to Schoharie, thence with a southerly curve along the Helderberg range to the Mamakating Valley. It exists also out of this general range in the base of Becraft's Mountain and Mount Bob, outliers of the Helderberg, east of North River, near the city of Hudson.

The typical fossils of the group given in the Reports, are embraced in the following wood cut.

Vanuxem's Report, p. 112.

Fig. 1. *Delthyris plicatus.* 2. *Avicula rugosa,* CONRAD. 3. *Tentaculites ornatus,* Sil. Res., p. 12, fig. 25. 4. *Littorina antiqua,* CONRAD. 5. *Atrypa sulcata,* VANUXEM. 6. *Cytherina alta,* CONRAD.

Fig. 3 is believed to be identical with a fossil found in slabs of limestone at Dudley in England, whose origin is still a matter of speculation. Some suppose the *Tentaculites* to be arms of *Crinoïdea;* others think they may be spines of *Leptæna.*

A *columnaria*, a peculiar *Strophomena*, and an *Agnostis*, perhaps the *pisiformis*, are enumerated as occurring in this formation.

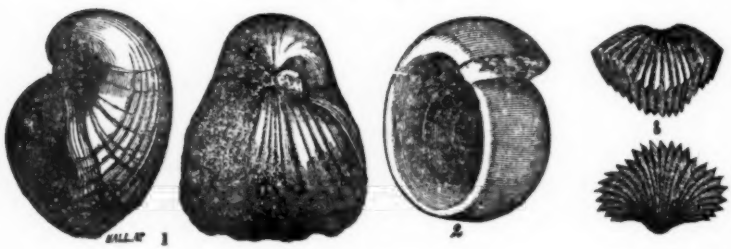
It is doubtful whether any strata identical with the water lime group of New York, exists in the West. It is true that one of the uppermost beds on the Falls of the Ohio is lithologically the same, and contains a *Tentaculites* and an *Avicula;* but they appear to be of species distinct from those which have been found in the New York water lime; besides, as we shall by and by see, the western hydraulic limestone is superimposed on beds which contain fossils identical with some in the upper Helderberg series, which proves it to occupy a higher geological position.

Pentamerus Limestone. (Part of No. 6 of the Pennsylvania survey.)—This, the third member of the Helderberg series, has received its name from the constant occurrence of a helmet-shaped *Pentamerus*, fig. 1 of the following wood cut. The name however is very objectionable, inasmuch as it does not distinguish it from other Pentamerus beds both below and above it.

This limestone, though well developed in the southern part of the state all along the Helderberg range, and in some of the middle counties, is not a universal formation. In thickness it varies from ten to eighty feet, and usually presents the appearance of an uneven bedded, rough, subcrystalline and highly fossiliferous, blackish gray, slaty limestone, with an interlamination of shale.

The fossils figured in Vanuxem's report, as characteristic of the Pentamerus limestone, are here given.

Vanuxem's Report, p. 117.



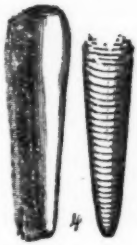
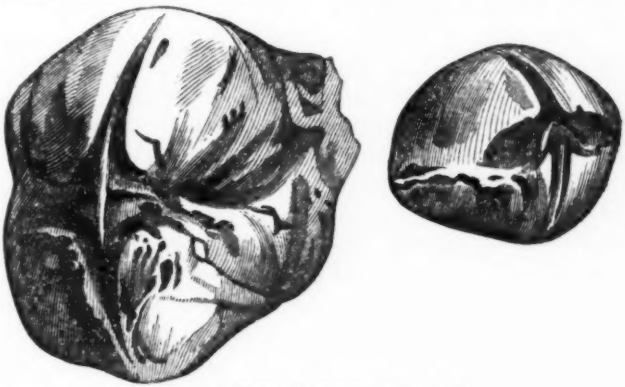


Fig. 1. *Pentamerus galeatus.* *Atrypa galeata*, DALM. 2. *Euomphalus profundus*, CONRAD. 3. *Atrypa lacunosa? Terebratula lacunosa* of Europe. 4. *Lepocrinites Gebhardii.*

It is supposed that Fig. 1 may be identical with the *Atrypa galeatus* of the Wenlock limestone. The English fossil seems, from a comparison of figures, to be of a more globular form, and to have its ribs more strongly marked, than the New York specimens; but these shades of difference are, perhaps, no more than we have reason to expect in the same species at distant points in their geographical range. The disparity in their generic names arises from the *Atrypa* and *Pentamerus* being distinguishable only by their internal structure, the latter being provided with internal vertical laminæ or projections, which give to its internal cast for a certain distance from the hinge five divisions, as is here represented, which are not ob-



Internal Casts of *Pentamerus*. Iowa.

servable in casts of the former. But it may be asked, may not this internal structure vary with the circumstances under which the fossilization has taken place? Might not the internal supports, under certain conditions, be absorbed during petrifaction without leaving any impress, either on the internal cast or inner concavity of the fossil shell? Is it not the rarest thing to find the spiral appendage of the *Spirifer* preserved? And has not its synonym *Delthyris* originated from this very cause?

Fig. 4 shows the outer and *inner* (?) structure of a *Crinoïdean* figured in a more perfected condition in MATHER'S report, p. 346, and first known as the Mulberry *Encrinite*. It is characteristic of

the middle part of the *Pentamerus* limestone, according to that author, whilst the *Asterocrinites pachydactylus*, fig. 6, p. 346, of the same report, is confined to the base of this limestone.

The other fossils named and described found in this formation, are, *Strophomena raristriata*, *S. rectilateris*, *S. depressa*, *S. elongata*, *Avicula naviformis*, *A. manticula*. "It also contains, according to VANUXEM, two *atrypæ* of a kind which first appear in this district and State in this rock, and there are three in all. Beyond this State there are others, one of which, being *A. capax* of CONRAD, exists in a lower position in Ohio and Indiana; the third, *A. cuboides*, is confined to the *Tully* limestone. The two found in the *Pentamerus* limestone closely resemble the *Terebratula Wilsoni* of English geologists." Nothing has yet been identified in the West, corresponding to this *Pentamerus* limestone.

Catskill Shaly Limestone, (*Delthyris Shaly Limestone, and Scutella Limestone of the yearly reports.*) (Part of No. 6 of Pennsylvania survey.)—This is one of the thickest members of the Helderberg series, and ranges all through the southern counties, extending as far west as the east end of Madison County. It is composed of "a dark bluish grey shale, with a fine grained blue limestone beneath, and a coarse limestone above;" the latter containing a great number of a discoidal-shaped fossil, probably the pelvis of an *Encrinite*, which bears a resemblance to a *Scutella;* hence has arisen the term, "*Scutella* limestone," as applied to the upper division of this formation. "Sparry limestone" is a synonym employed by GEBHARD to designate the same rock. In the first or southern geological district, where this group is upwards of a hundred feet thick, three divisions have been recognized.

a. An upper, coarse, uncrystalline limestone, containing a great many shells and *Encrinites* along with some corals,—Catskill shaly limestone.*

b. A middle slaty limestone equally fossiliferous.

c. A lower slaty argillo-siliceous limestone, abounding in *Strophomena rugosa*,† fig. 2, p. 312 of Vol. XLVIII, of this Journal.

The whole comprises, according to MATHER, a series of strata, perhaps, more highly fossiliferous than any rock of equal thick-

* In HALL's report this division is described as a distinct formation under the name of "Encrinital limestone."

† Since the former number of the Review was written, we have seen specimens of this fossil. It is much larger and more strongly wrinkled than the western fossil there spoken of.

ness in the state. Many of its organic remains are in a wonderful state of preservation, so that under the lens, the most minute structure of the smallest corals can be discerned.

The best sections are exposed on Catskill Creek, in Greene County, along the railroad. This locality gave origin to the name by which this formation is usually designated. It is also well exposed near the village of Schoharie, at Sharon Springs; near the Great Falls of Esopus, and at Rochester in Ulster County. Outliers of all the three divisions, besides other members of the Helderberg series, exist on the east side of North River, on Becraft Mountain and Mount Bob near Hudson, lying unconformably on the subjacent slaty rocks.

A few of the most common fossils are embraced in the following wood cuts.

Fig. 1. *Strophomena punctulifera*, Conrad. 2. *Strophomena radiata*, Conrad.

"These fossils occur in the *Delthyris* shaly limestone of New York, but at the West the *S. punctulifera* holds a higher position."*

* Does Mr. Hall mean by "West," the Western States or the western part of the State of New York? We are not aware of the *S. punctulifera* having been found in the Western States.

We understand Mr. Hall to say that he found *Strophomena* near the Falls of Ohio, which at the time he considered *S. punctulifera;* but all the *Strophomena* are *punctate* or *striato-punctate* when the shell is removed or partly removed, and there is great difficulty in identifying the one intended by Conrad as *S. punctulifera*, which is not *punctate* when the shell is perfect. By "West" Mr. Hall means the Western States.—*Eds. Am. Jour. Sci.*

Hall's Report, p. 120.

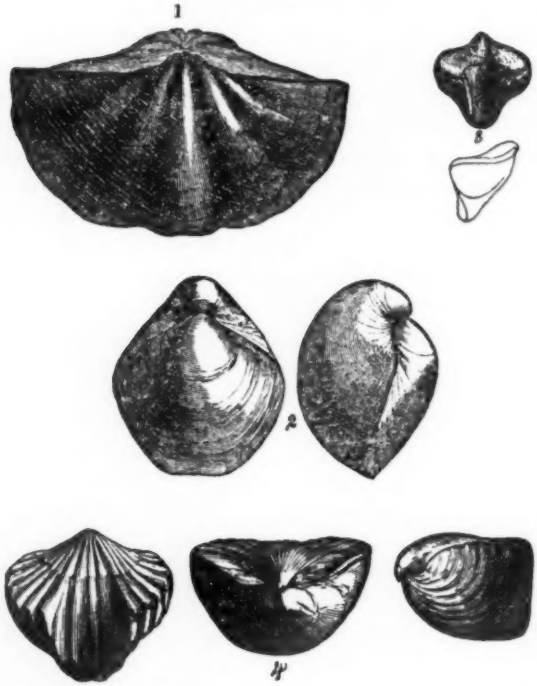


Fig. 1. *Delthyris macropleura.* 2. *Atrypa lævis.* 3. *Atrypa singularis.* 4. *Atrypa medialis.*

We have not been able to identify these forms with any western fossils which have as yet come under our notice. There is, therefore, neither palæontological nor lithological evidence, at present, of the existence of equivalent beds in the Western States or Territories.

Amongst the numerous beautiful fossils of the Catskill shaly limestone not yet published, there are several which HALL informs us are very analogous to the following forms figured on Pl. 13 of the Silurian Researches, and found in the Wenlock shale of England,—*Orthis hybrida, O. canalis, Atrypa rotunda, A. linguifera*, and several others.

The following is a list of fossils of this formation which have been described by CONRAD in the annual reports:—*Acidaspis tu-*

berculatus, Acanthaloma, Asaphus pleuroptyx, Asaphus nasutus, Dicranurus, Calamopora (favosites) favosa, Delthyris bilobata, D. granulosa, D. macropleura, D. pachyoptera, Orthis, Strophomena indentata, Atrypa prisca, A. inflata, A. concentrica, Platyceras ventricosum, P. Gebhardii, Calceola plicata, Conularia quadrisulcata, Tentaculites scalaris.

GEBHARD, jr., has distinguished a limestone resting upon, yet distinct from the Catskill shaly limestone, under the name of the "upper *Pentamerus* limestone," which contains a smooth species of *Pentamerus,* in its general form like *P. galeatus;* also several forms of *Atrypa* similar to those which occur in the inferior beds of this group.

Oriskany Sandstone. (No. 7 of the Pennsylvania survey.)—Though this formation, in some parts of the first district, is only a few inches thick, and never exceeds in any part of the State of New York thirty feet, yet in Pennsylvania and Virginia it becomes a very conspicuous member of the Appalachian system, attaining, in the former state, the enormous thickness of seven hundred feet. In New York the Oriskany sandstone is confined chiefly to the middle and southern portion of the state, not extending further west than Morganville, Genesee County.

Its lithological character is, for the most part, a tolerably pure siliceous or quartzose sandstone of a white or yellow color. At Schoharie and the Helderberg generally, it becomes, however, a compact, tough, siliceous limestone. Very frequently it is full of cavities, the hollow moulds of shells which chemical agencies have removed. It is worthy of note, as VANUXEM remarks, that "this sandstone and the calciferous sand rock, including the Potsdam sandstone, are the only two rocks of the third district, (and we presume also in every part of the state over which the New York system extends,) which presents unaltered the pure sand of the primary region."

From the irregular thickness of the Oriskany sandstone in the middle part of the state, and the apparent depressions which it fills up on the surface of the Onondaga salt group, where the intervening strata are absent, it has been suggested by HALL that the more elevated and exposed portions of this underlying formation might have been, during the deposition of the siliceous rocks under consideration, dry land, or at least was beyond the reach of

detrital deposition, and that too for a long period, viz. whilst the deposition of the two *Pentamerus* limestones and interposed *Delthyris* shaly limestone was going forward; each of which formations must have required an immense lapse of time, since each contains a peculiar assemblage of fossils.

These are the most abundant organic remains of the Oriskany sandstone.

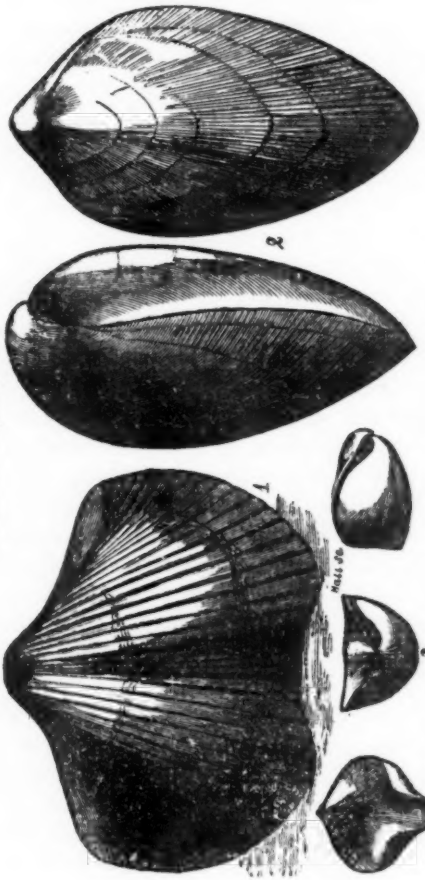


Fig. 1. *Delthyris arenosa*, Conrad. 2. *Atrypa elongata*, Conrad. 3. *Atrypa peculiaris*, Conrad.

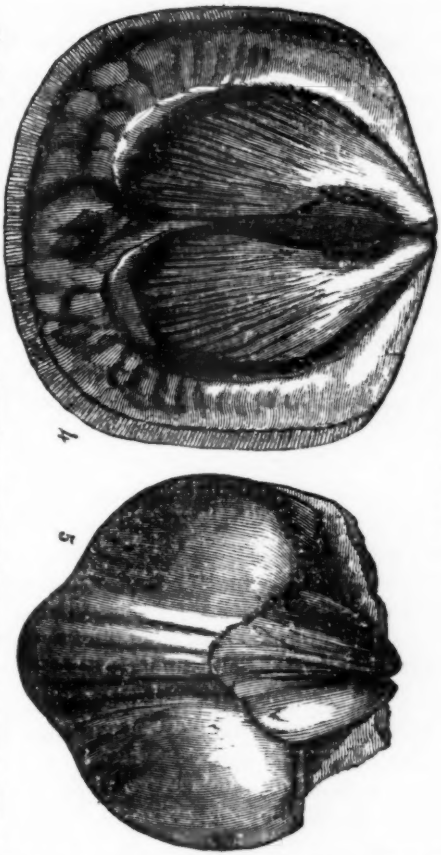


Fig. 4. *Atrypa unguiformis*, Conrad. (*Hipparionyx proximus*, Vanuxem.) 5. Cast of *Delthyris arenosa*, fig. 1.

Vanuxem's Report, p. 134.

Casts are of more frequent occurrence than perfect fossil shells, as is apt to be the case both in sandstones and magnesian limestones. One of these, fig. 4, from its strong resemblance to a colt's foot, has been called by Vanuxem, *Hipparionyx proximus*, believing it to be a genus intermediate between the *Atrypa*, *Strophomena*, *Orthis* and *Pentamerus*.

None of these forms, as far as we know, have been discovered, either in the western U. S. or England. It is remarkable, however, seeing that no other rocks of like lithological character are found in the upper or middle part of the New York system, that there exists at the falls of Fall Creek, near the central part of the State

of Indiana, apparently in an isolated position,* a fine grained, white and yellowish siliceous sandstone, evidently very similar to the Oriskany sandstone, and which cannot be far removed from the same geological horizon; yet, since this Fall Creek rock is particularly characterized by casts of *Pleurorhyncus*, (one of which is, probably, the *cuneatus*,) and postabdomens of a *Calymene*, that it is the western representative of the Schoharie grit. It is not at all improbable, however, that here are blended together the three adjacent siliceous formations of the Helderberg series, —the Oriskany sandstone, and overlying *Cauda-galli* and Schoharie grits; for we find that though the upper layers in which the *Pleurorhyncus* occurs, effervesce with acids, there is beneath a whiter variety, of quite a different appearance, destitute of calcareous matter, in which, as yet, no fossils have been observed.

The eastern shore of Cayuga is a good locality for collecting the fossils of the Oriskany sandstone.

The purer varieties of this rock are used in the manufacture of glass at Vernon. Some iron ore has been procured in the ferruginous layers near Perryville; but all that has hitherto been obtained, was found to be too much contaminated with sand to be of economical value, as is too often the case where hydrated oxide of iron has been infiltrated amongst sandstones.

Caudi-galli Grit.—This and the succeeding formation are of limited extent and of little importance; so that we shall pass them over with only a few remarks. The *Caudi-galli* grit is an argillo-calcareous sandstone, usually of a drab color or brownish hue, containing remarkable plumose impressions, supposed to be *Fucoides*, which have given name to the rock.

Schoharie Grit, is a calcareous sandstone, which, when weathered, becomes porous and colored with ferruginous stains. "It abounds in a species of *Pleurorhyncus* and *Orthoceras*, along with many corals, and is well developed at Schoharie and the Helderberg.

Besides the siliceo-calcareous, *Pleurorhyncus* rock above cited, as occurring in the middle of Indiana, there is a porous siliceous rock full of casts of corals found in the southern part of the same state, particularly near Vernon, in Jennings County, and on Ra-

* The extensive drift formation of this part of Indiana, renders it difficult to ascertain the area over which these siliceous rocks prevail.

coon Creek, where it is quarried for millstones and sold under the name of the Racoon Creek burr; they are however, for the most part, too soft, owing to the presence of calcareous matter. This is, very likely, the western equivalent of the porous part of the Schoharie grit.

Onondaga Limestone.—Though not exceeding ten or fourteen feet in thickness, this rock is wonderfully persistant. In consequence of the absence of the strata which intervene between it and the Onondaga salt group, through a great part of Western New York, this limestone often rests on the impure limestone, the terminal mass of the salt group, with sometimes a few inches of sandstone, or a band of non-fossiliferous bluish grey limestone intervening.

The Onondaga limestone is, for the most part, a pure calcareous rock, with thin partings of greenish shale between the beds, often made up of the fragments of *Crinoïdea* and corals, particularly species belonging to the genera *Cyathophyllum* and *Favosites*. These are not unfrequently of a pink or reddish color, which gives the rock a pretty variegated appearance, and renders it well suited for a marble. "When thinly laminated by these seams of shale, and the surface covered with encrinital columns and plates, as it usually is," HALL informs us, "the rock bears most striking resemblance to the Wenlock limestone of England, as seen in some specimens from Wenlock which were presented by Mr. LYELL. So complete is the resemblance in some instances, that one might almost be mistaken for the other. Judging, however, from the general character of specimens and the description of Mr. MURCHISON, there is a greater amount of shale intermixed with the Wenlock limestone, than with our rocks at the same period."

"The similarity or even identity of specimens from Dudley in England with those from the Niagara group, has been remarked; if this inference be correct, of which there seems no doubt, then we find a wide separation here between rocks which in England constitute one group. That such is the fact appears plain; for there are many fossils of the limestones above the salt group, which are identical with the Wenlock formation, while the identity of so many species of the Niagara group leaves no doubt of perfect correspondence. We are therefore to look upon the salt group as a formation, on this continent, coming in at a period du-

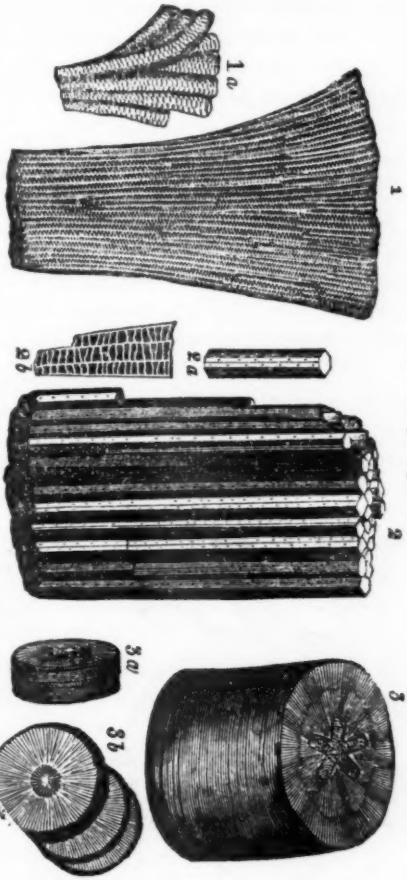
ring which, in England, the rocks are supposed to belong to a continuous group, or to be parts of one formation." (HALL's report, pp. 152, 153.)

This seems to be also the case in the Western States of North America; for, on comparing the eastern and western formations, it is difficult to say where the geological horizon lies in the West, that separates the beds representing the Niagara and Onondaga formations. Speaking of the former of these in a previous part of this Review, we expressed an opinion that the coralline beds of the vicinity of the Falls of the Ohio might be the equivalent of the Niagara group, but that, until more of the corals of this New York formation were described and figured, the absolute identity could not be established. We should have said, *part* of the coralline beds, instead of coralline beds; for we shall see, on comparing the corals of the Onondaga limestone with western fossils, that many of them are the same species which occur in these same coralline beds. The fact is, these strata probably admit, as Dr. CLAPP has suggested, of a twofold division into upper and lower beds; and a minute comparison of eastern and western specimens, will most likely prove the lower of these to be the equivalent of the Niagara group, whilst the upper represents the Onondaga limestone; the intervening salt group and Manlius water limestone having no western representative. The coralline beds of the magnesian limestones of the northwest, most probably belong to the lower or Niagara division.

The range of the Onondaga limestone is coëxtensive with the limits of the state, and is represented, together with the succeeding formation, on the chart by a light blue band, whose general course is nearly east and west to Schoharie, thence, with a southerly curve coincident with the Helderberg range, to the Mamakating Valley.

Well defined joints in two directions, are particularly characteristic of this formation, which admits of its being got out in very regular blocks. A fine example of this is seen at Split-rock quarry, southwest of Syracuse.

The large, smooth *Entrochites*, fig. 3, p. 59, provisionally called *Encrinites lævis*, is an exceedingly abundant fossil of the Onondaga limestone. The same encrinite "exists in prodigious numbers," according to VANUXEM, "ten miles north of Nashville, Tennessee. The following corals are also very common.



Hall's Report, p. 157.

Fig. 1 and 1a. *Favosites alveolaris*. 2. *F. Gothlandica*. 2a. A single tube magnified twice, and presenting a double row of pores upon the side. 2b. A fragment from a honey-comb specimen, showing the transverse lamellæ. 3, 3a and 3b. Fragments of crinoidal columns, showing the pentapetalous canal and crenulated edges of the plates.

Perhaps no protozoic fossil has a wider range than Fig. 2 of this illustration, *Favosites Gothlandica*. Not only does it occur in the limestones of Gothland, the Eifel and Groningen, as well as the magnesian limestones of Gerolstein in Europe, but also in the Wenlock limestones of England. In this country it is by no means confined to the State of New York, but is found in great perfection in the coralline beds in the vicinity of the Falls of the Ohio, in Kentucky, Tennessee and Indiana, and also in the magnesian limestone of the lead regions of Iowa and Wisconsin. Indeed every locality in the West where the middle protozoic strata

reach the surface, seems to afford specimens of this columnar and honey-comb shaped coral. LONSDALE's remark, with regard to the identity of this species and the *Basaltica*, holds good also with regard to the structure it exhibits in the western country. On the same specimen, a single, double, or even triple row of pores may be observed; so that no specific distinction can be founded on the number of rows of pores on the partition walls.

Fig. 1 is also a western fossil; at least, Dr. TROOST enumerates this species amongst corals found in Perry County, Tennessee, and the coralline beds near the Falls of the Ohio furnish a species apparently the same, though, in consequence of the difficulty of distinguishing the position of the pores in the specimens on hand, we cannot speak positively. The last mentioned locality in the West, as well as the magnesian limestones of the northwest of Illinois, near the lead region, afford fine specimens of the tuberose varieties of Fig. 1. (No. 62, p. 159, HALL's report.)

Hall's Report, p. 159.

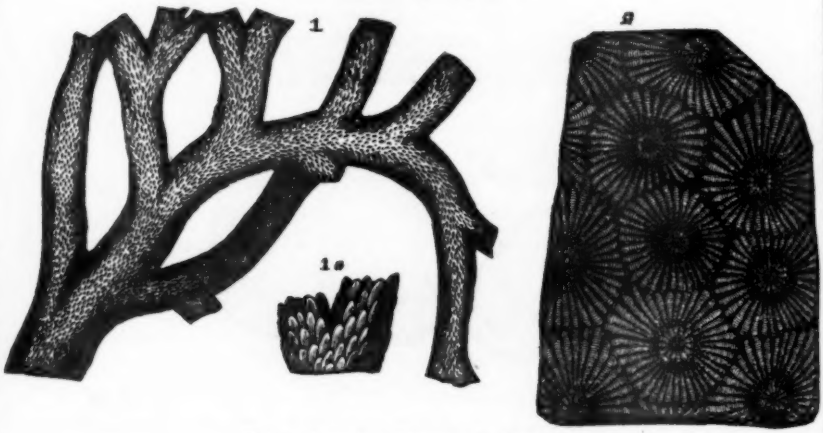


Fig. 1. *Favosites fibrosa?* 2. *Astrea ragosa.*

The limestone of Iowa City, (known as the Iowa City marble,) in the southwest part of the Du Buque district of Iowa, is almost made up of coral, the transverse section of which closely resembles Fig. 2 of the above wood cut, except that the stars are only about three twelfths of an inch across. The Iowa fossil is however not lamelliferous, but presents the appearance of long, irregular hexagonal columns, grouped close together after the man-

ner of basaltic columns. A magnificent coral of snowy whiteness, of similar structure, with the prisms more than a foot long, and in masses weighing nearly a ton, was discovered many years ago at Charleston Landing, about eight miles above the Falls of the Ohio, in the coralline beds already referred to.

Fig. 1. *Cyathophyllum* ——? 2. *Cyathophyllum dianthus.* 3. *Syringopora* ——?

Hall's Report, p. 160.

Until the internal structure of Fig. 1 is described, it would be premature to decide upon its identity with fossils of other localities; but in its general form and external appearance it resembles a species found in abundance at Utica, a few miles above the Falls of the Ohio, and elsewhere in that vicinity. The same locality also furnishes specimens that are doubtless the same as Fig. 2.

On the Mississippi, a little below the mouth of Rock River, in limestone, probably an extension of the Iowa City rock, a coral abounds resembling Fig. 3, but the cylinders of which the group is composed are of larger size. We have been disposed to consider it *Cyathophyllum cæspitosum*, inasmuch as it shows no appearance of a syphon nor transverse connecting tubes.

Along with these are found *Cyathophyllum flexuosum*, and *C. ceratites;* hence EATON's name for this limestone, "ceratial rock."

Corals are far more numerous than shells in the Onondaga limestone; in VANUXEM's report, however, the following *Testacea* are figured, which we are informed are generally diffused in, and appear to be confined to this rock in the third district. They do not appear, however, to have a wide range beyond this region of the state.

Vanuxem's Report, p. 137.

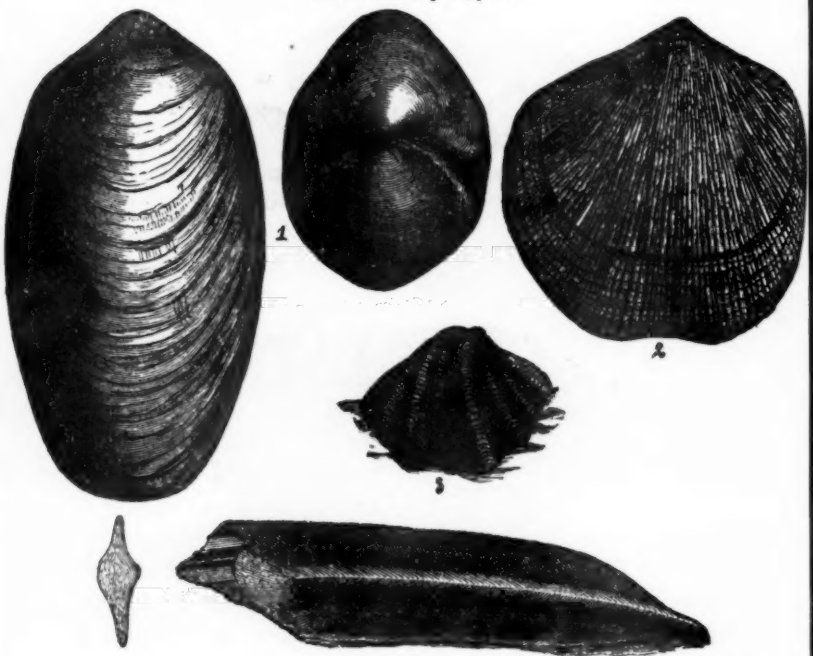


Fig. 1. *Pentamerus elongata*. 2. *Hipparionyx (Atrypa?) consimilaris*. 3. *Delthyris undulatus*.

In the shell strata on the Falls of the Ohio, there are vast numbers of *Delthyris*, which, in their general form, resemble Fig. 3 of this wood cut; but they are much smaller than this figure, and its ribs are finer and more numerous, (from sixteen to eighteen.) Dr. CLAPP has called it *Delthyris gregaria.*

This is the lowest position in the State of New York, in which any remains have been found of animals higher in the scale of organized beings than *Crustacea*, with the exception of an imperfectly preserved fish-bone discovered by HALL in the Oriskany sandstone. That specimen, together with the defensive fin bone, Fig. 4, found in this part of the New York system, furnishes evidence of the existence of animals belonging to the class *Vertebrata*, during the deposition of the middle part of the protozoic strata. Besides these, VANUXEM mentions a gigantic species of *Cyathophyllum*, (*C. gigantea*,) as peculiar to this rock, some over eight inches long. On the Falls of the Ohio, *Cyathophylla* occur nearly as long as a man's arm, (*C. gigas* of CLAPP.) Perhaps the western and eastern species may be found to be identical.

CONRAD has also described and named the following fossils from the Onondaga limestone: *Asaphus aspectans, Delthyris raricostata, Strophomena gibbosa, S. perplana, Atrypa nasuta, A. unisulcata, A. acutiplicata, Avicula pecteniformis, Cypricardites inflata, Bellerophon curvilineatus, Pleurotomaria Poulsoni, P. unisulcata.*

The foregoing affords strong presumptive evidence that the upper coralline beds of the Falls of the Ohio are equivalent to the Onondaga limestone of New York. Since many more corals than have been described or enumerated occur in these formations, we shall be better able to judge of their parallelism after the publication of the volume on the palæontology of the State of New York. Dr. TROOST's description of the fossil corals found in the limestone of Perry County, Tennessee, leaves little room to doubt that there, and at the locality of the *Encrinites lævis*, ten miles from Nashville, mentioned by VANUXEM, will be found their south western representative. Dr. TROOST enumerates, amongst other fossils of that part of Tennessee, *Calamopora* (*favosites*) *favosa, basaltica, alveolaris* and *spongites;* besides several species of *Cyathophylla.*

The upper calcareous bed near the falls of Fall Creek, (Pendleton marble,) agrees in lithological character, external appear-

ance, and geological position, with the Onondaga limestone; but we have, as yet, no evidence derived from organic remains.

Thus it would appear that the Onondaga limestone, though of no great thickness, has still a vast range both west and south, hundreds of miles beyond the limits of the State of New York.

At many localities, particularly in the vicinity of Cherry Valley, the rock in question receives a good polish and forms a handsome marble.

HALL suggests, what is highly probable, that the origin of this formation has been a coral reef; where it is thickest, he thinks the larger and more hardy species existed; where thinnest, the tender corals and *Crinoïdea* flourished in sheltered situations, most of which were, by the action of a troubled sea, overturned, broken down and scattered over the bed of the primeval ocean.

The best localities in the state for studying this formation and its organic remains, are, near Williamsville, on the farm of Mr. Youngs, in the town of Amherst, Erie County; in Clarence, in the same county; at the quarries of Le Roy, Genesee County; in Caledonia, west side of the Genesee, and at Vienna; on the road from Fort Plain to Cherry Valley, Otsego County; near Syracuse, Onondaga County; and at the falls of Perryville and Cazenovia. On the Helderberg Mountains, in Sharon, Bern and Bethlehem, are some of the best localities in the first district for collecting specimens of its fossil corals.

Speaking of its mineral contents, HALL says: "Crystallized carbonate of lime, quartz in crystals lining cavities, chalcedony and hornstone, with iron pyrites, are the only minerals noticed in this rock." Its thickness, the same author informs us, is very variable, being from one to twenty, or even forty feet; but VANUXEM says, it very rarely exceeds ten or fourteen feet.

Corniferous Limestone of EATON, (embracing the Seneca limestone.)—This name was given to the member of the New York system now to come under review, by EATON, in consequence of the number of flinty and hornstone nodules which it contains. These are arranged usually in layers something like flints in chalk, and accompany the rock, according to VANUXEM, throughout its entire range. It was not separated by EATON from the Onondaga limestone, both being included under this head; now they are separated into two formations, because each is found to contain a peculiar assemblage of fossils, besides differing in lithological

aspect; for the corniferous limestone is more compact, of a finer grain, and contains many more flinty layers and nodules than the last described formation. Though mostly of light grey or bluish tints, the corniferous rock assumes, at some localities, especially at Black Rock, a very dark color. It is more persistent in its lithological character than the Onondaga limestone, and of greater thickness, varying from twenty to seventy feet.

Along with the last formation, it forms the upper calcareous terrace of the Helderberg range, and with the Onondaga salt group forms the second limestone terrace south of Lake Ontario in HALL's district.

Its range and outcrop are represented on the chart by the same blue band that marks the limits of the last formation which it immediately overlies, and with which it is coëxtensive, appearing, however, always as the thicker and more prominent member. These together with the previously described members of this division, have a southerly dip and pass under the Marcellus shale.

The corniferous limestone imparts to the scenery of a country where it prevails, a peculiar and constant feature; for "all the small streams as they pass over it, form rapids or cascades of more or less extent." It is the barrier at the outlet of Lake Erie, and the rapids at Black Rock are produced by the descent of the waters of the Niagara River over its beds.

Like the preceding, it often lies regularly jointed in the quarries. At Seneca there are dislocations of such a nature that seem to indicate an undermining; this has been attributed to the removal of the soft gypsum rock beneath.

Instead of the corals and *Crinoïdea* of the last formation, we find in the corniferous hardly any thing but shells. HALL is of opinion that about the time of the deposition of this rock, the bed of the ocean sunk beyond the influence of the light and the particular temperature favorable for the growth of *Polyparia*; and by oscillations of the surface, the previously existing tribes of that order were overwhelmed and covered up by a calcareous mud.

The most fossiliferous part of this rock is the upper portion, when free from hornstone and chert. "Amongst these are two trilobites, the *Odontocephalus selenurus* of Green, Fig. 1, Pl. 33, (VANUXEM's report,) and a *Calymene*. So abundant is the former of these at Schoharie and other places, that it alone is the

fossil entirely relied on, and the rock is known as the 'Selenurus rock.' The other trilobite is scarcely less characteristic. In many places in the third district, and in Seneca County in the fourth district, the *Strophomena lineata* of CONRAD is the typical fossil, but it rarely occurs at any point west of the last named locality."*

Some of the most abundant fossils of Western New York, figured in HALL's report, are given below.

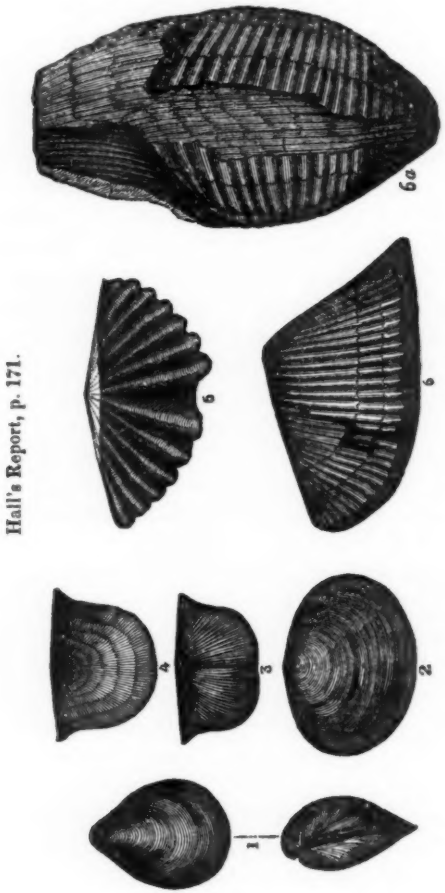
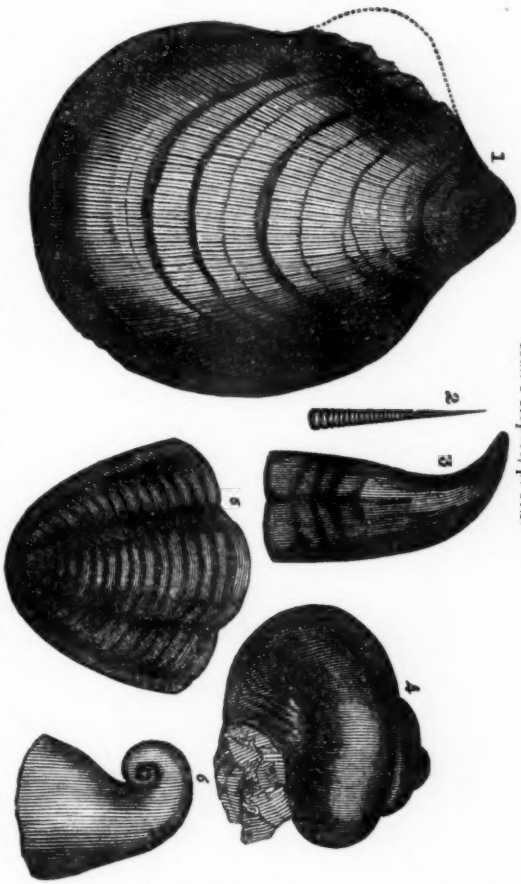


Fig. 1. *Atrypa reticula*, H. 2. *Paracyclas elliptica*, (like *Cyclas*.) 3. *Strophomena acutiradiata*, H. 4. *Strophomena crenistria*, H. 5. *Delthyris duodenaria*, H. 6. *Pleurorhynchus trigonalis*, H.

* Hall's report, p. 170.

Of these the *Pleurorhyncus*, fig. 5, has probably the widest range; at least there is a *Pleurorhyncus* found in the shell strata of the Falls of the Ohio, which bears a strong resemblance to this figure. The principal difference is, that the full grown western species seems to have a greater number of ribs than the eastern, fig. 25. There are other shells in the same rock of a type analogous to figs. 2 and 4, but the specific identity cannot at present be established.

In the report of the fourth district, the following characteristic fossils occur in the rock at Williamsville, Erie County.



Hall's Report, p. 172.

Fig. 1. *Pterinea* (?) *cardiiformis*, H. 2. *Tentaculites scalaris*, Schlot. S. R. 3. *Orthonychia*, a new genus, from its resemblance to a claw or talon. 4. *Exomphalus* (?) *rotundus*. 5. *Calymene crassimarginata*. 6. *Acroculia erecta*.

Figs. 4 and 5 are identical with specimens in our possession from the shell strata of the Falls. Fig. 2 is supposed to be of

the same species as one which is abundant both in the Caradoc formation of England, and the Hudson River group of New York. The Ludlow formation of England, affords a species which MURCHISON informs us, cannot be distinguished from that of the Caradoc. The blue limestone of Cincinnati contains a *tentaculites*, but the specimens on hand are not sufficiently distinct to enable one to decide on specific identity. Dr. CLAPP has found a *tentaculites* in the water limestone, but he supposes it to be a new species.

The figures given by VANUXEM as most abundant in the corniferous limestone in his district, are the following:

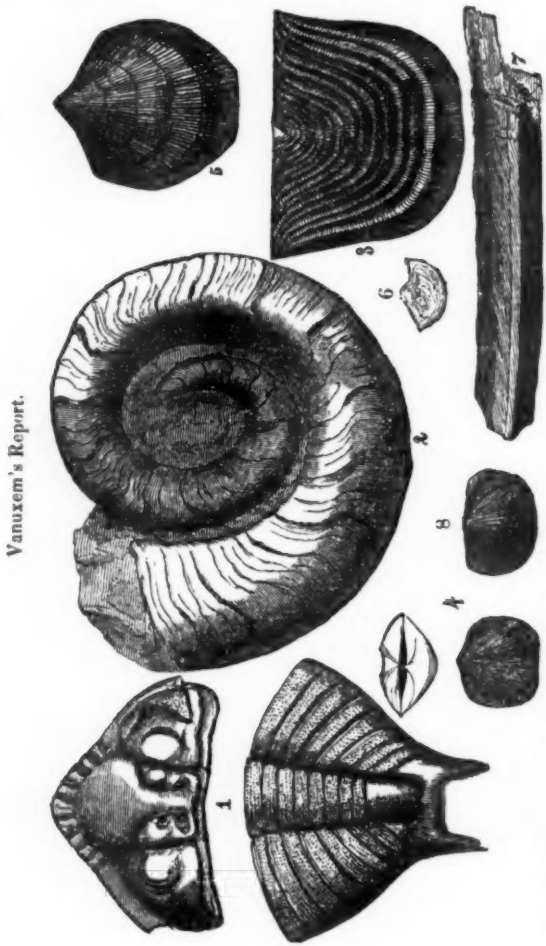


Fig. 1. *Odontocephalus selenurus*, CONRAD. 2. *Cyrtoceras undulatus*, VANUXEM. 3. *Strophomena undulata*. 4. *Orthis lentiformis*. 5. *Atrypa prisca*. 6 and 7. *Ichthyodorulite*. 8. *Strophomena lineata*, CONRAD.

Fig 5 is the only one of these which we know has been found West; it occurs in great abundance in the shell strata of the Falls of the Ohio, and, at some localities, is common also in the water limestone above; in fact it is by far the most conspicuous fossil in both these rocks. Speaking of the organic remains of the corniferous limestone in the vicinity of Williamsville and several points between that place and Buffalo, HALL remarks: "It is particularly interesting from containing numerous fossils of the genera *Strophomena*, *Delthyris* and *Pleurorhyncus*;" if he had added *Atrypa*, this observation would have been equally applicable to the shell strata on the Falls of the Ohio.* All this goes to show, almost conclusively, that these shell beds, the western water limestone, and the corniferous rock, were deposited at the same period of time; the more especially since they are overlaid, at both localities, by a black bituminous shale so different from the underlying members of the middle division of the New York system.

There are numerous localities where the corniferous limestone can be studied: we may mention particularly the quarries in Seneca County, the bed of Flint Creek at Vienna, the outlet of Canandaigua Lake, and the bed of Mud Creek. At the village of West Mendon, near the village of Caledonia, and between this and Le Roy, the strata are well exhibited, but few fossils occur. At Clarence Hollow, this rock contains a few fossils not elsewhere seen.

In consequence of the fissured, or rather disjointed state of the beds constituting this rock formation, water often percolates to a considerable depth before it reaches an impervious stratum; there accumulating, it at length flows out some distance down the northern outcrop in copious and refreshing springs, imparting verdure and beauty to the scene beneath, which forms a striking contrast to the arid and barren ledges above. Streams, too, often disappear in the vacant spaces of the creviced rock. From the same cause, the vegetation over the limestone is more vigorous immediately above the cracks of the rock than elsewhere, owing to the moisture beneath rising by evaporation and capillary attraction to the rootlets of the overgrowing plants.

"Few simple minerals present themselves in this formation; hornstone sometimes passes into chalcedony, and crystallized

* In a crystalline layer of limestone interposed between the shell stratum and the water limestone, we found a *Conularia* which seems to be the same species as the *quadrisulcatus* of the Wenlock limestone.

quartz is rarely found. In its cavities at Black Rock, dog-tooth spar sometimes occurs; at the same place, fluid bitumen or petroleum is found, usually filling the cells of the *Favosites.*"

The upper coralline beds of the Falls of the Ohio, include a "black stratum," containing many corals; this is, in all probability, the western representative of these dark colored beds at Black Rock.

With the Seneca limestone, the uppermost bed of the corniferous formation, terminates upwards the Helderberg series of the geographical division; so also is it the last member, in the ascending scale, of the the transition series between the middle and upper division, according to the chronological scale. Here also is the close of all the important *limestones* of the New York system, for the calcareous deposites above are but thin and local in their extent. D. D. O.

(To be continued.)

ART. VI.—*Musci Alleghanienses, sive Spicilegia Muscorum atque Hepaticarum quos in itinere a Marylandia usque ad Georgiam per tractus montium A. D.* MDCCCXLIII, *decerpserunt* ASA GRAY *et* W. S. SULLIVANT: (*interjectis nonnullis aliunde collectis:*) *Concinnavit et exposuit* W. S. SULLIVANT. Fascis I, II. Columbus in Ohione, MDCCCXLV.

THIS beautiful *publication*, as it may be justly called, although not intended for sale, consists of about fifty presentation copies, or sets of the specimens themselves, with printed labels, titlepages, and index, prepared at no small labor and expense, and in an unusually elegant style, for distribution among the principal muscologists abroad, and those most interested in these pursuits at home. A *work* it may with literal propriety be termed, since, beside the labor of collection, of which the writer may speak from some actual knowledge, the manual preparation, arrangement, and critical study of the materials, with the subsequent journeys that have been required for the sake of rendering certain portions more complete, have fully occupied all the zealous author's available time for the two years which have elapsed since the plants were gathered.

The collection fills two large quarto volumes, and comprises 215 species or marked varieties of true Mosses, and 77 of Hepaticæ,—in all 292. We should render a service to this beautiful and too much neglected department of American botany by copying the whole list: we will at least find room for the new species which are here proposed and characterized; since the work must, from the necessity of the case, have but a limited circulation, and may fail to reach many who are interested in the subject. In these instances we copy the original tickets entire, with the numbers under which they appear, as follows.

7. HYPNUM PALUDOSUM (*n. sp.*).

Dioicum; caule procumbente flexuoso radiculoso-tomentoso diviso, divisionibus elongatis ascendentibus simpliciter pinnatis; ramulis compressiusculis; foliis cordato-lanceolatis acuminatis erecto-patentibus plicatis margine reflexis costa ad apicem evanida carinatis.

Medium inter *H. Blandovii* et *H. plicatum.*

HAB. in editoribus Ohionis septentrionalis paludibus *Cranberry Marshes* dictis.

62. LESKEA DENTICULATA (*n. sp.*).

Caule repente fastigiato-ramoso; ramis erectis confertis compressiusculis; foliis dense imbricatis subsecundis ovatis subito longeque acuminatis ecostatis concavis denticulatis rhomboideo-areolatis; capsula ovali-oblonga, operculo oblique rostellato.—Pterogonium filiforme, var.? HOOK. et WILS.! *in Drumm. Musc. Amer. n.* 86.

HAB. ad arbores in jugo excelso *Balsam Mountain* dicto, Carolinæ Superioris.

89. LEPTODON OHIŒNSE (*n. sp.*).

Caule repente; ramis julaceis vage ramosis; foliis dense imbricatis madore horizontaliter patentibus costa valida ultra medium abrupte desinente instructis: cætera, excepta statura minore, *L. trichomitrii.*

HAB. circa urbem *Columbus* in Ohione; rarum.

170. SYRRHOPODON? EXCELSUS (*n. sp.*).

Densissme cæspitosum, fastigiato-ramosum; ramis corpusculorum (fl. abortiv.) congestis acervulis terminatis; foliis lineari-

subulatis convoluto-canaliculatis ecostatis subsecundis nitidis albido-viridibus, e compluribus stratis tubulosarum cellularum formatis. . . . . .

Hab. in sylvaticis depressis inter montes Alleghanienses, ad arborum truncos putredine decompositos; necnon in Ohione haud infrequens, at semper sterile. Beat. T. G. Lea, scrutator muscorum in vicinia urbis *Cincinnati* indefessus primum detexit.

176. Trichostomum vaginans (*n. sp.*).

Dioicum, innovando-ramosum; ramis erecto-flexuosis gracilibus; foliis erecto-adpressis ovato-lanceolatis, perichæthialibus longe vaginantibus apice subito attenuatis patentibus costa valida excurrente instructis, areolatione mediocri; capsula ovali-oblonga; operculo longe obtusque conico; dentibus peristomii breviusculi binatim inter se anastomosantibus; membrana basilari haud emergente; annulo speciosissimo; flore masculo terminali; antheridiis elongatis paraphysatis.—*T. pusillum*, Hook. et Wils. *in Drumm. Musc. Amer. No.* 60 *et* 61.

Hab. in terra argillacea ad loca *Swananoa Gap* et *Hickory-Nut Gap* dicta, in Carolina Superiore.

182. Fissidens exiguus (*n. sp.*).

Annuus, dioicus; caule simplici; foliis 5–9-jugis oblongo-lanceolatis immarginatis integerrimis, costa ab apicem dissoluta; capsula terminali subobliqua vel erecta; operculo conico-rostellato; calyptra cuculliformi; flore masculo terminali.

Hab. in sylvis, ad rivulorum exsiccatorum lapides, prope *Columbus* Ohionis copiosissimus.

183. Fissidens minutulus (*n. sp.*).

Annuus, dioicus; floribus terminalibus; caule simplici; foliis 5–12-jugis, superioribus lineari-lanceolatis margine limbo subrepando haud incrassato plus minus circumdatis; costa sub apice evanida; capsula erecta ovali; operculo elongati-conico; calyptra cuculliformi.

Hab. iisdem in locis cum præcedente, rarius.

201. Sphagnum strictum (*n. sp.*).

Caule erecto subsimplici rigidiusculo; ramulis 4–5-natim fasciculatis, duobus æqualibus strictis obtusis horizontaliter patenti-

bus, reliquiis deflexis, fasciculis confertis; foliis oblongo-acuminatis recurvis apice eroso 6–9–dentatis.

Hab. in montibus Carolinæ Superioris, ad scopulum mirabilem *Devil's Court House* dictum.

204. Sphagnum tabulare (*n. sp.*).

Pusillum; caule erecto; ramulis substrictis æqualibus 3–4–natim fasciculatis; fasciculis approximatis; foliis ovato-lanceolatis reflexiusculis apice truncato 3–5–denticulatis.

Hab. in locis irriguis ad cacumen scopuli *Table Mountain* dicti, Carolinæ Septentrionalis, altitudine circ. 2500 ped.

205. Sphagnum molle (*n. sp.*).

Tenellum, dense cæpitosum; caule erecto subindiviso; ramulis erecto-patentibus confertissimis indistincte fasciculatis; foliis oblongo-ovatis apice eroso-3–5–denticulatis.

Hab. in eodem loco ac No. 201.

221. Plagiochila macrostoma (*n. sp.*).

Amphigastriis parvis subulato-bifidis, aut nullis; perianthio obconico ore compresso: cætera *P. interruptæ*, cujus forsan sit insignis varietas.

Hab. in ligno putrido humique circa Columbus Ohionis, rarissima.

222. Plagiochila undata (*n. sp.*).

Caule repente; ramis adscendentibus simpliciusculis rigidulis; foliis arcte imbricatis horizontaliter divergentibus subhomomallis semicordatis apice obtusis vel emarginatis ibidemque parce dentatis, margine dorsali reflexa integerrima, ventrali basique in cristam reflexa repando-undulata; amphigastriis linearibus bipartitis dentatis.

Hab. in rupibus humo tectis ad flumen *Savannah*, prope Augustam Georgiæ.

223. Plagiochila Ludoviciana (*n. sp.*).

Caule repente; ramis adscendentibus parce ramosis flexuosis; foliis imbricatis patenti-divergentibus dimidiato-ovatis apice sub-

emarginato-bi-tridentatis basi subtus in cristam conniventibus margine dorsali reflexis integerrimis, reliquo ambitu spinulosodentatis; amphigastriis profunde bi-trifidis, laciniis linearibus ciliato-dentatis; flore fœmineo terminali.—*Jungermannia spinulosa*, Hook. et Wils! *in Drumm. Musc. Amer.* No. 160.

Hab. ad cortice arborum in Ludovicia et Alabama.

270. Frullania Caroliniana (*n. sp.*).

Caule repente irregulariter bi-tripinnato; foliis dense imbricatis ovali-rotundis, auriculis parvis elongatis a caule distantibus, plica styliformi interjecta; amphigastriis ovato-rotundis caule duplo latioribus bifidis, laciniis subrepandis; perianthio compresso-pyriformi ventre obtuso carinato.

Hab. in cortice arborum prope Wilmington, Carolinæ Septentrionalis.

286. Marchantia disjuncta (*n. sp.*).

Dioica; receptaculo fœmineo excentrico subsepteno-radiato, radiis apice cuneato-dilatatis emarginato-crenulatis subtus dense barbatis; involucro mono-tricarpo subintegerrimo; receptaculo masculo semicirculari 7-radiato, radiis usque ad brevem pedunculum discretis; fronde dichotoma et articulatim innovante: cætera *Marchantiæ polymorphæ*.

Hab. ad ripas præruptas fluminis *Alabama* prope *Clairborne*.

And finally we have a newly characterized genus, which is however equivalent to a badly described one established by the late Mr. Schweinitz, under a name already preöccupied.

NOTOTHYLAS, *Sulliv.*

Carpobolus, Schweinitz *in Jour. Acad. Nat. Sci. Philad.*, 2 *p.* 336 (1822). *Targioniæ spec.* Schweinitz, *Hepat. Am. Sept. p.* 23. *N. ab E. Europ. Leberm.* 4, *p.* 317.

Monoica. Fructus dorsales sparsi. *Involucrum* sessile, frondi continuum initio clausum, tandem superne fatiscens. *Perianthium nullum. Calyptra* . . . . . *Capsula* involucro inclusa, oblongo-sphæroidea, compressa vel ovato-cylindrica, brevissime pedicellata, pedicello in bulbo incrassato affixo, sutura longitudinali ab apice ad medium subbivalvatim vel (sutura deficiente) frustulatim dehiscens. *Columella* linearis. *Sporæ* quaternatim ag-

gregatæ, subglobosæ, læviusculæ. *Antheridia* frondi immersa, elliptico-globosa. Frons orbicularis, laciniata, tenera, papuloso-reticulata, margine undulato-crispa, subtus radiculosa, massis granulatis hic illic immersis.

Plantæ annuæ, terrestres, limicolæ, in umbrosis Ohionis Carolinæque Septentrionalis observatæ.

289. NOTOTHYLAS VALVATA (*n. sp.*).

Fronde diametro 3–8-lineari; involucro horizontali deflexo corniformi; capsula elongato-cylindrica curvula sutura colorata semper instructa; sporis luteolis subfuscisve.

HAB. in humidiusculis circa Columbus Ohionis sat frequens.—Maturescit Æstate—Autumno.

290. NOTOTHYLAS MELANOSPORA (*n. sp.*).

Capsula sutura omnino nulla; columella appendiculata; sporis atro-fuscis dimidio majoribus quam in præcedente: cæteris conveniunt.

HAB. iisdem in locis cum priore, rarissima.

Spec. adject. NOTOTHYLAS ORBICULARIS, *Sulliv. l. c.*

Involucro suberecto; capsula oblongo-ellipsoidea compressa cum vel absque sutura concolori: cætera ut in *N. valvata.*—Carpobolus orbicularis, *Schweinitz, l. c.* (Diagnosis secundum specimina *Schweinitziana* in *herb. Acad. Nat. Sci. Philad.*)

The collection also embraces many re-discoveries of no little interest, as well as brief critical remarks and rectifications of synonomy which will be valued by the muscologist. We note some of the points that strike us as we turn over the pages.

No. 2 is *Hypnum umbratum* of EHRHART, collected on the Grandfather Mountain, and also since communicated by Mr. OAKES from the White Mountains of New Hampshire. It is here for the first time recorded as an American species. No. 48, *H. demissum* of WILSON, also from the rich sides of the rugged Grandfather, is equally new to America, and in fact is quite a recent discovery in Europe. No. 5, *H. gracile*, was intended as one of the new species of this work, but its publication has been anticipated by BRUCH and SCHIMPER. No. 6, *H. scitum*, is doubtfully referred to that species of BEAUVOIS. If the reference prove

to be wrong, it must bear the name of *H. intertextum*, Muhl. Cat., which name Mr. SULLIVANT has authenticated by the inspection of the remains of the Muhlenbergian herbarium. No. 9, *H. alopecurum*, LINN.; to this Mr. SULLIVANT refers the *H. neckeroides* of HOOKER. Under No. 11, *H. strigosum*, HOFFM., two nominal species are reduced, namely, *H. attenuatum*, BRIDEL, described from Torreyan specimens, and *Leskea fasciculosa*, HEDW., furnished by MUHLENBERG. The synonomy of No. 14, *H. Haldanianum*, GREV., is for the first time set in order. It includes not only *H. curvirostrum* of BRIDEL, but also *H. pulchrum* of DRUMMOND, and *H. Cooleyanum* of SPRENGEL. No. 15, *H. suberectifolium*, BRIDEL, has not until now been heard of since it was detected by Bosc. No. 17, *H. recurvans*, SCHWÆGR., is a re-discovery of one of MICHAUX's mosses; and No. 19, *H. reptile*, is another species of MICHAUX. No. 20, *H. pratense*, KOCH., is very little known, except by its occurrence by mistake in some of the copies of DRUMMOND's Northern Mosses, under his *H. amænum*. To No. 30, *H. varium*, BEAUV., a fine set of synonyms, too numerous to mention, are reduced; and it is hinted that perhaps the whole should be referred to *H. serpens;* which would be in accordance with the views of that acute botanist, Mr. ARNOTT. No. 31, *H. confervoides*, BRID., no doubt the same as the Pennsylvanian plant mentioned by SCHWÆGRICHEN, is perhaps distinct from the original European species. To No. 46, *H. riparioides*, HEDW., the *H. prolixum* of MICHAUX is referred. No. 50, *H. deplanatum*, SCHIMPER, Mss., seems to be a common moss, though as yet it is undescribed. To No. 57, *H. confertum*, DICKS., are reduced *H. serrulatum*, from MUHLENBERG, (which was previously suspected,) and *H. cupressetorum*, furnished to BRIDEL by TORREY. The specimens of No. 58, the pretty *Hookeria lucens*, were the first detected in the United States, but we believe Mr. SULLIVANT has quite recently found it in Ohio also.

No. 60 is published as a marked variety of *Leskea polyantha*, HEDW.; but it is very likely a new species. No. 64, *L. compressa*, is a re-discovery of a moss which HEDWIG received from MUHLENBERG. The ticket of No. 65, *L. adnata*, MICHAUX, is crowded with interesting synonomy, the result of acute research. To No. 68, *L. obscura*, HEDW., the *L. gracilescens* is referred, from actual examination of the original specimens of MUHLENBERG. No. 69, *L. nervosa*, is the *Pterogonium nervosum* of SCHWÆG-

RICHEN, &c., here removed to *Leskea*. No. 70, *L. flaccida*, is a re-discovery of a well marked species sent to BRIDEL by TORREY. No. 71, *L. fragilis*, HOOK. and WILS., which has a range from Montreal to New Orleans, is still distributed without fruit, which is a great desideratum. To No. 72, *L. intricatula*, HEDW., a goodly number of nominal species are referred.

No. 79, *Neckera breviseta* of HOOKER and WILSON, is deemed by Mr. SULLIVANT to be much more nearly allied to *N. Cladorrhizans*, than to the species with which these authors compare it.

To No. 80, *Clasmatodon pusillus*, HOOK. and WILS., Mr. SULLIVANT refers with some doubt the *Leskea parvula* of HAMPE, and also *Pterigynandrum marginatum* of MICHAUX; if incorrectly, then this species of MICHAUX still remains to be identified.

No. 81, *Cryphæa filiformis*, BRID., which is very common in the Southern States, is said to have spores four times larger than those of *Daltonia heteromalla*.

No. 82, *Anacamptodon splachnoides*, BRID. Mr. SULLIVANT has discovered that the genus *Campylodontium* of SCHWÆGRICHEN was founded on specimens of this moss, which had lost their opercula and inner peristome! (Cf. *Schwægr. Suppl. t.* 52, *cum t.* 211.)

No. 84, *Pterigynandrum intricatum*, HEDW., has as a synonym the *Pylaisæa heteromalla*, BR. and SCHIMP., which these authors detected in DRUMMOND's Northern Mosses, (given by mistake as *Hypnum polyanthum*,) but did not recognize. The *P. julacerem*, HEDW., here becomes No. 87, *Leucodon julaceus*.

No. 88, *Leptodon trichomitrion*, MOHR., is distinguished from the new species that follows it by "statura majore, ramis pinnatim ramosis, foliis humectatis erecto-patentibus ecostatis." SULLIV. *mss.*

No. 92, *Mnium affine*, var. *minor*, is the *M. Drummondii*, BR. and SCHIMP.

No. 115, *Pogonatum capillare*, BRID., the *Polytrichum capillare* of MICHAUX, is kept separate from *P. urnigerum*, and additional characters are given for distinguishing it. The specimens are from the White Mountains of New Hampshire.

No. 135, *Ptychomitrium pusillum*, BR. and SCHIMP., has some important synonyms for the first time referred to it, viz. *Grimmia incurva*, MUHL., *G. Muhlenbergi*, BRID., *G. Hookeri*, DRUMMOND, and *Notarisia Virginica*, HAMPE.

No. 139, *Grimmia conferta*, FUNCK, now first recorded as an American moss, was collected on the White Mountains of New Hampshire by the indefatigable Mr. OAKES.

No. 159, *Dicranum fulvum*, HOOK., is a rare species; and 167, *D. cerviculatum*, HEDW., (Hoboken, New Jersey, TORREY,) here first appears as an American moss.

Besides the two new species of *Fissidens*, the No. 180, *F. hyalinus*, WILS. and HOOK., and No. 181, *F. obtusifolius*, WILS., and also the rare *F. grandifolius* from Niagara, No. 186, are here for the first time distributed. But perhaps the most interesting moss in the collection, is the *Phyllogonium Norwegicum*, BRID., No. 108, which is found at Lancaster, Ohio, with female flowers, but, although closely watched for some years, it has not been known to produce the fruit.

The *Fontinalis disticha*, HOOK. and WILS., is given under three forms, (No. 190–192,) which it is thought will sustain the species.

No. 196, *Physcomitrium sphæricum*, BR. and SCHIMP., var. *insignis*, capsula immersa foliis serratis, is very likely a new species.

No. 198, the curious *Schistidium serratum*, HOOK. and WILS., is here provided with the following character: Annum, monoicum; flore masculo fœmino approximato nudo vel 1–2–3–phyllo in foliorum axillis comalium sessili; antheridiis 4–12; paraphysibus apice globoso-distentis.—Habitu, foliis, calyptra ut et florum situ structuraque *Phasco patenti* omnino simile, diversum tamen capsula operculata et pachyderma; hic ad *Physcomitrium*, illic ad *Pottiam* accedit.—The characters of the masculine flowers, as here indicated for this plant and the closely allied *Phascum patens*, are important, since their structure and position have been entirely misapprehended by HEDWIG, BRUCH and SCHIMPER, and all former observers, who say that they are borne on proper branches arising from the base of the main stem, that there are no paraphyses, &c.

No. 207, *Sphagnum macrophyllum*, BRID., is a most remarkable species, as well in habit as in the absence of spiral-threaded cells. No. 208, *S. sedoides*, BRID., is a re-discovery of a plant found long since by LA PYLAIE in Newfoundland. Dr. TORREY recently brought it from Mount Marcy in Northern New York. These are the only localities known, except the moist top of that singular natural tower, *Table Rock*, South Carolina, which is completely edged with it. Its slender prostrate stems may be procured a foot or so in length.

No. 214, ***Andræa Rothii***, is here first published as an American moss; but we believe that SCHWEINITZ had found it in the mountains of Virginia.

Passing to the ***Hepaticæ***, No. 220, ***Plagiochila porelloides***, LINDENB., is here first made known in fruit, and with amphigastria, which had been overlooked. The proposed new species of the genus we have already given. No. 227, ***Jungermannia Taylori***, HOOK., collected by Mr. OAKES in New England, is here first enumerated as American. No. 260, ***Radula complanata***, var.? sive n. sp.? and No. 261, ***R. pallens***, are in the same case. No. 271, ***Frullania Hutchinsiæ***, var. foliis subintegerrimis, is a striking variety of a very rare plant, not before found out of Ireland. It was detected in moist rocks at the Mountain Cataract of Pigeon River Falls, along with ***Hookeria lucens*** and (on the dried summits of the rocks) ***Andræa Rothii***. No. 274, ***Lejeunia cucullata***, N. ab E., 275, ***L. calcarea***, N. ab E., and 276, ***L. minutissima***, DUMORT., are likewise new to North America. Nos. 289, 290, ***Notothylas***; this interesting genus will probably soon be illustrated by Mr. SULLIVANT.

This work lays the foundation for the study of North American Muscology among us. We now only wait for a ***Species Muscorum*** of the United States, to facilitate the study of the family for students generally, and this we trust Mr. SULLIVANT will not be long in giving us.

The view of these beautifully prepared specimens as here presented to us, brings back to recollection their appearance as they grew in their fresh native wilds, and vividly recalls the varied incidents of the arduous but delightful journey during which they were principally collected,—the laborious mountain-ascents, the night bivouacs, the healthful woodland life and primitive fare, and the many amusing adventures, of a tour which extended along the principal length of the Alleghany Mountains, through much of their most picturesque scenery, and through regions which abound with the choicest botanical treasures which the country affords. A cursory indication of the particular routes pursued will not be deemed superfluous, since it is recorded by our author only in the general terms of the title page. The expedition, which had for its principal object, on the part of one of its members, the collection of live plants for the Cambridge Botanic Garden, may be said to have commenced, late in August, 1843, in the mountains

of Maryland and Pennsylvania, where they are traversed by the Cumberland road. From the Potomac at some distance above Cumberland, the great *Back Bone* of the Alleghanies was crossed in Maryland, where it presents a pretty formidable elevation, and several plants were observed which were thought to be confined to a more southern range, such as *Menziesia globularis* and *Galium latifolium*. The open *glades* on the other side presented many features of Kentucky vegetation. Virginia was entered near Mount Carmel Town, and a rude, wild region was traversed to Tygart's Valley River, in Randolph County. The high Cheat Mountain was then crossed nearly where it merges in the Green Brier range, and *Angelica Curtisii*, Buckl., as well as *Aconitum reclinatum*, Gray, were first met with. In the journey through Pocahontas County to Huntersville, fruiting specimens of the little known *Rhamnus parvifolius*, Torr. and Gr. Fl., were collected, a species which proves to be a perfectly distinct one, and has also been found by Mr. Buckley in Alabama. In the route eastward across the mountains from Huntersville to the Warm Springs, the rare *Helianthus lævigatus*, Torr. and Gr., and *Andromeda floribunda*, Pursh., (which is *A. montana* of Buckley,) were abundantly found. A mountain meadow on Nap's Creek, east of Huntersville, also furnished a stout *Gentian* with crowded ochroleucous flowers, and with much the habit of *G. Andrewsii*. It was naturally enough confounded with *G. ochroleuca*, and specimens have been distributed under this name. It is however quite a different species from the real *G. ochroleuca*, though it may be the plant figured under that name in *Sims. Bot. Mag. t.* 1551, as well as the form mentioned by Grisebach (in Hook. fl. Bor. Am.) as remarkable for its cordate-lanceolate leaves. Our *Gentians* will soon be cleared up, we trust. Meanwhile a temporary diagnostic character is given below.* From the Warm Springs the expedition pursued its course, by way of the Hot Springs and the White Sulphur Springs, along the base of Peter's Mountains to the Kanhawa River, which was crossed at Toney's

* Gentiana flavida, (Gray:) caule erecto lævi; foliis e basi cordata arcte semiamplexicauli ovato-lanceolatis sensim acuminatis subtrinerviis margine scabriusculis; floribus terminalibus aggregatis sessilibus; calycis lobis ovatis tubo plusquam dimidio corolla multo brevioribus; lobis corollæ apertæ ochroleucæ (intus haud viridi vel purpureo picta) ovatis plicas denticulati-erosas integras subduplo excedentibus; capsula intra corollam persistentem fere inclusa; seminibus latissime alatis.—Stet inter *G. ochroleucam* et *G. Andrewsii*.

Ferry below Parisburg, and thence to Tazewell County. In Giles County, soon after crossing the river, live roots of the very rare and distinct *Heuchera hispida*, Pursh., were obtained, which have been preserved in cultivation. Clinch River was crossed above Saltville, and the North Fork of the Holston at Seven-mile Ford; the Middle Fork was ascended to within a few miles of the place where the writer crossed the Iron Mountains on a previous journey, and this range was ascended by a new road a little farther westward. In consequence of this, the remarkable *Carex Fraseriana* was met with, in immense quantities, through some miles of moist wood-land, within the borders of Virginia, whence an adequate supply has been secured for cultivation. Entering Ashe County, North Carolina, the Negro Mountain was first visited; the Grandfather sedulously re-explored; and then Table Mountain was visited by crossing the Blue Ridge into Burke County. Besides the plants before known at this locality, a single patch of the curious *Schweinitzia* was found. Continuing southward to the Catawba, the Blue Ridge was again traversed by Swananoa Gap into Buncombe County, and the route along the French Broad River explored to the Warm Springs, Paint Rock, and to within the borders of Tennessee; where, among the phanerogamous plants obtained for cultivation, the most interesting is the *Buckleya* of Torrey, a Santalaceous shrub, allied to *Pyularia*. Here the expedition bifurcated, to use a botanical phrase,—one of its members crossing the Cumberland Mountains into Kentucky; the other, returning to Ashville, visited Hickory Nut Gap, then explored the high mountains in Haywood and Henderson Counties, near the sources of the French Broad and Pigeon Rivers, (the Great Balsam Mountain, the Devil's Court House, &c.;) again crossed the Blue Ridge to Cæsar's Head, in South Carolina, ascended the far-famed Table Rock, which is certainly one of the greatest curiosities in the United States; thence continued his course to Augusta, Georgia, and returned northward by the usually travelled route. We must not prolong this article by farther notices of the interesting plants, which the memory of this botanical journey so vividly recalls to mind.

A. Gr.

ART. VII.—*An attempt to refute the Reasoning of* LIEBIG *in favor of the Salt Radical Theory;* by ROBERT HARE, M. D., Prof. of Chem. in Univ. of Pennsylvania. (In a letter to the Editors.)

1. *Gentlemen*—My attention was lately drawn to two lectures delivered about eighteen months ago, by LIEBIG, in support of the salt radical theory. You are well acquainted with the efforts made by me to refute that hypothesis, in an essay published under your auspices.* Your opinions, as well as those of several of the more distinguished of our American chemists whom I have consulted, have been emphatically expressed in favor of the validity of my reasoning. Nevertheless from the lectures above mentioned, and from a text book lately published by GREGORY, the successor of HOPE, it appears that, by these eminent professors, innovations are to be supported which have, on this side the water, been deemed indefensible. Under these circumstances, I again raise my voice against this new doctrine, hoping that although an ocean rolls between those who may be led astray and the author of this communication, his warning may be neither unheard nor unheeded.

2. Pursuant to the new doctrine, every oxacid is to be considered as a hydruret of a compound radical, as those heretofore called hydracids are hydrurets of simple radicals, so that both of these classes are to bear the name of hydracids.

3. Agreeably to the nomenclature proposed by DANIELL, the hydrated sulphuric, nitric and phosphoric acids consist of hydrogen in union severally with oxysulphion, oxynitrion and oxyphosphion, their formulæ being respectively SO^4H, NO^6H, PO^6H.

4. According to a definition given by LIEBIG, at the close of his second lecture, "*acids are compounds of hydrogen with simple or compound radicals, in which the hydrogen may be replaced by its equivalent amount of metal.*"

5. Inferring that in those oxacids which unite with water as a base, the oxygen of the water goes to form a compound radical, the constitution of these acids is considered as quite analogous to that of the compounds formed with hydrogen by halogen bodies,†

* See this Journal, for Jan. 1843.

† Chlorine, bromine, iodine, fluorine and cyanogen, are by BERZELIUS distinguished by the generic name halogen, from Greek words which convey the idea

whether simple, like chlorine, bromine, iodine and fluorine, or compound, like cyanogen. Hence the term hydracid, heretofore confined to the haloid compounds of hydrogen, and those formed by this element with sulphur and selenium, is to be extended to all the hydrated oxacids. Moreover respecting oxacids which are incapable of uniting with water as a base, the distinguished lecturer holds the following language. "*I maintain that they are not acids. Do you find any of the characteristic properties of the hydrogen acids, in chromic acid, boracic acid, silicic acid, titanic acid, antimonic acid, or in their combinations with metallic oxides?*"

6. The lecturer also uses the following language. "*The compound which we denominate hydrated sulphuric acid, possesses properties analogous to hydrochloric acid.*" And again: "*There is no proof that our common sulphuric acid contains water; but we can prove that its chemical character, analogous to that of hydrochloric acid, depends, as in that acid, on the presence of hydrogen. We can prove that this hydrogen can be replaced by its equivalent of metal.*"

7. This celebrated author has, in a preceding paragraph, urged "*that the so called anhydrous sulphuric acid, and phosphoric acid, do not possess any of the characteristic properties of acids; these they obtain only by their combination with water.*"

8. As the characteristic properties of "the hydrogen acids" are not only in the instances here cited, but in others, repeatedly insisted on by LIEBIG as a corner stone of the new system, it is unfortunate that they are no where described. It is to be regretted that LIEBIG does not specify any properties characteristic of acidity, which belong both to the hydrated oxacids and the gaseous "*hydracids*" (so called) formed by the union of hydrogen with the halogen bodies of BERZELIUS. Neither the latter nor the former, while undiluted, are endowed with sourness, nor with the

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of salt and to produce. Common salt, from which the notion of salt first originated, being a binary compound of chlorine and sodium, all other binary compounds of chlorine, or of any of its congeners which belong to his halogen class, are called salts, and the compounds of these double salts, although there are no bodies in nature more dissimilar in their properties than some of those thus constituted; as for instance the gaseous compounds formed with hydrogen, the volatile liquid and fuming chlorides of tin and arsenic, the butyraceous chlorides of zinc, bismuth and antimony, and such inert chlorides or fluorides as horn silver, horn lead, and fluor spar.

ability to redden litmus; and were they thus endowed, it could not be of any importance to the argument, since according to LIEBIG, "*We have long since abandoned the position, that mere reaction with test paper should decide whether or not a body should be called an acid or not.*" But if reaction with test paper be thus set aside, the inferior test of sourness cannot but share the same fate.

9. It seems to me that there has been a lamentable deficiency of precision in LIEBIG's expressions respecting the resemblance between the hydrated oxacids and the haloid* hydracids. I call upon him, or any of the advocates of the salt radical theory, to point out any peculiar attributes of acidity belonging to them in common. The whole source of this idea would seem to be a vague conception, that the vulgar attributes of acidity belonging in common to diluted sulphuric and diluted muriatic acid, are attributable to the hydrogen of the basic water in one case, and that of the hydrogen of the gaseous chloride in the other. But to lay any stress on this resemblance, is irreconcilable with the above quoted allegation of the celebrated author, that the effect upn test paper is no longer to be considered as an evidence of acidity. Yet besides this attribute and that of sourness, what other common properties, distinctive of these diluted acids, can be imagined? The evolution of hydrogen by reaction with metals, cannot avail unless water, equally capable of that reaction, be made an hydracid, and oxygen consequently transferred to the halogen class. But if this transfer be made, the salts heretofore considered as simple amphide salts, become as well entitled to be deemed double haloid salts, as any of the double chlorides.

10. Is it not evident that the whole of this salt radical doctrine, as presented by LIEBIG, is founded on an unnatural and arbitrary peculiarity attached to oxygen on one side, and to hydrogen on the other, by which each of these elements is treated as a body *sui generis?* Upon what rational ground is oxygen separated from the other electro-negative elements forming the amphigen and halogen bodies of BERZELIUS?

11. If chlorine be a simple radical, wherefore is not oxygen a simple radical? But if oxygen be a simple radical, agreeably to LIEBIG's definition above quoted, (3,) water, the oxide of hydro-

* A haloid compound is one which contains a halogen body as an ingredient.

gen, is as much entitled to be considered as an hydracid, as muriatic acid, (the chloride of hydrogen.) The oxide, no less than the chloride, consists of a "*radical in combination with hydrogen in which the hydrogen may be replaced by a metal.*" Hence, as no rational line of demarcation can be drawn about oxygen, so as to separate it from its congener chlorine, it follows either that all the compounds consisting of two chlorides, and hitherto called double chloro-salts by BERZELIUS, are consistently simple chloro-salts; *or*, that all compounds consisting of two oxides and called simple, should be considered as double oxysalts.

12. The supposed hydracids, consisting of oxacids containing only basic water, being liquid, while the hydracids proper, when equally devoid of water, are aëriform; had the comparison been made between them, neither being associated with water as a solvent, the idea of any similitude could hardly have arisen. Besides unless so associated, they are generally insusceptible of change by reaction with metals without heat, and when subjected to decomposition, there is no analogy in the result. In the case of hydracids proper, the halogen body uniting with any metal presented to it, hydrogen is evolved; but in that of the hydrated oxacids, the alleged compound radical is decomposed with an evolution of some combination of the non-metallic ingredient with oxygen. Thus instead of hydrogen, sulphuric acid yields sulphurous acid, nitric acid yields nitric oxide. It follows that the presence of basic water alone, does not fulfill the conditions of LIEBIG's definition, since *per se* the hydrogen entering into combination with the alleged compound radical, cannot be replaced by a metal.

13. It may be expedient here to advert to the fact that in the case of magnesium and aluminium, oxygen plays the same part in taking place of chlorine and causing the *chloride* of hydrogen to be evolved, that chlorine performs in the cases of various oxides in which oxygen is replaced by chlorine and the *oxide* of hydrogen is evolved. Again, the reaction of muriatic acid with any bromide or iodide of which the metallic ingredient prefers chlorine to bromine or iodine, is analogous to the reaction of the same hydracid with certain oxides which prefer chlorine to oxygen.

14. It is therefore clear that in the reaction of haloid compounds with each other and with oxides, there is a perfect analogy, and that the erection of a special genus for oxygen is unjustifiable.

This conclusion is fortified when oxygen is considered in relation to sulphur or selenium, with which it is classified by BERZELIUS. There is, as I think, also a perfect analogy between the reaction of water with certain metallic sulphides, and of muriatic acid with certain oxides; and I presume that the same may be said of the reaction between water and some selenides.

15. As respects the propriety of holding up hydrogen as an element *sui generis*, the advocates of the salt radical doctrine do not agree with each other; since according to KANE, and GRAHAM also if I remember right, hydrogen is an aëriform metal, an opinion which I embraced independently more than twenty years since. But I trust that in my essay above alluded to, LIEBIG's reasoning in reference to this question is shown to be founded upon this palpable inversion of the truth, that the capacity of acidifiable radicals for metals is assumed to be dependent on the quantity of hydrogen with which they are capable of combining; instead of the quantity of hydrogen which can unite with them, being directly as their capacity for it or any other body in the table of equivalents.*

In a communication which I intend to send you for the next number of your Journal, I hope to proceed with the refutation of LIEBIG's reasoning.

ART. VIII.—*Account of observations on Shooting Stars at the meteoric periods of August* 10 *and November* 13, *in the year* 1845; communicated by E. C. HERRICK.

ARRANGEMENTS were made here for meteoric observations during the nights of the 8th, 9th, 10th and 11th of August, 1845. Casually, on some of the earlier evenings of this month, meteors seemed by brief observation, to be more numerous than usual, but as there was no systematic watch, nothing definite can be stated concerning their numbers.

The evening of the 8th was almost wholly overcast, and the sky continued cloudy during the night.

On the evening of the 9th, Messrs. GEO. C. MURRAY, and WM. MANL. SMITH with myself, commenced observations in the open

* See paragraphs ninety one, &c. in my Essay in this Journal, for Jan. 1843.

air, at 10h. We saw some meteors previous to this time, but have not included them in our enumeration. Between 10h and 11h, we observed *sixty four* different meteors as follows, viz. in

N. N. E. 22. S. E. 20. S. W. 22.

During this hour the sky was not entirely clear, and our view was somewhat obstructed by trees. These obstacles may have occasioned a loss of about one tenth. Of the shooting stars observed many were conspicuous, and left brilliant trains. The apparent paths of the majority of them, if traced back, would meet near the sword-handle of *Perseus;* as has been observed on many former occasions, at this period. Soon after 11h the sky became much clouded, (but not until we had seen seventeen meteors more) and as late as 1 A. M. (10th) offered no chance for observation. At this hour we left the field, and have reason to suppose that the sky continued cloudy until daylight.

The night of the 10th was overcast and rainy. The night of the 11th was similar; and on neither was any observation practicable.

On referring to our observations at the August period in former years, it appears reasonable to conclude, even from the limited observations which the weather permitted us, that the expected display did not fail this year; and that had our sky been clear on the nights of the 9th and 10th, we might have seen (if four had been observing) shooting stars between midnight and dawn at a rate not less than 150 an hour.

By a notice in *L'Institut*, No. 606, Paris, 13 Août, 1845, it appears that in France, (at Paris?) M. Coulvier-Gravier, aided by two companions, observed and registered shooting stars, on the night of Aug. 9th, 1845, as follows:

from 9 to 10 P. M.	60	from 12 to 1 A. M. (10th)	77
" 10 " 11 "	63	" 1 " 2 " "	117
" 11 " 12 "	64	" 2 " 3 " "	136

As to direction it is merely remarked that the majority came from the northeast.

Observations at the November Meteoric period.

Since the year 1838, no decided return of the meteoric display of November has been announced; nor indeed does the theory proposed by Prof. Olmsted, require the annual occurrence of this phenomenon. It is nevertheless quite important that observa-

tions should be maintained, in order, either to determine the negative, or else to secure the first symptoms of a return of the grand meteoric shower, which sooner or later may be expected at this period.

November 11, 1845. Being called out by an alarm of fire, I watched for five minutes, about 2 A. M., and saw no meteors. The sky was very clear and the moon shone bright.

Nov. 12. On looking from an open window at $5^h\ 15^m$ A. M., I found about one third of the sky almost clear. The constellation *Leo* was wholly unobscured and also a large space around, quite enough for one observer. In a few minutes I was at my station in the open air and began the watch. The clear space gradually contracted, and within fifteen minutes the sky became wholly overcast. During this brief period, I did not certainly observe even *one* meteor, although I suspected that I caught glimpses of two.

Nov. 13. Mr. J. H. Lane and myself began the watch at $4^h\ 10^m$ A. M. The sky was clear, except there was a bank of clouds low in the northwestern horizon, not however interfering with observation. During the hour ending $5^h\ 10^m$ our region (from N. by way of E. to S. 10° W.) remained clear, and we observed *six* different meteors. One of the six was seen by both, but was only once counted. Of these six, five were conformable to the radiant in *Leo*, and four left luminous trains. Mr. Fr. Bradley, watching at a separate station, from $3^h\ 45^m$ to 5^h A. M., looking easterly, observed nine shooting stars, eight of which were conformable.

Nov. 14. At 3 A. M. I looked from an open window and found the sky so hazy that stars below the second magnitude were not visible. During a short period of observation, not exceeding five minutes, I saw not even a single meteor.

It should be remembered, that during this period, the moon, nearly full, was above the horizon, concealing about three fourths of the meteors that might have been seen in her absence. But even with this allowance, it must be admitted that the results above recorded indicate no recurrence of the meteoric shower of November.

New Haven, Conn., Nov. 1845.

ART. IX.—*Attempt to Demonstrate the Assumed Point in the Doctrine of Parallels;* by A. C. TWINING, Prof. of Math., Nat. Philos. and Civil Engineering, in Middlebury College.

A CONCISE and rigorous demonstration of what is called the *postulatum* of EUCLID,—that is to say, that *two straight lines which make, with a third line, interior angles together less than two right angles, will meet if indefinitely produced*,—is still accounted among geometrical writers a desideratum. The author of the able Treatise on Geometry put forth in England by the "Society for the Diffusion of Useful Knowledge," not only announces the difficulty in the text itself, but declares, in a scholium, that it is agreed by geometers that some assumption is indispensable. The numerous although abortive attempts, however, to resolve the difficulty, extending from the earliest periods of the science quite down to our own times, and still in process of continuance, evince that a hope at least is still entertained by the lovers of exact reasoning of wiping away the reproach, as they esteem it, of their favorite branch of knowledge.

It is here worth an inquiry why the one difficulty in the doctrine of parallels has monopolized attention and anxiety to the exclusion (to say nothing of a plain assumption in the 21st of the first book of EUCLID, and the same in the corresponding 9th of the first book of LEGENDRE, which however I expect at some subsequent opportunity to exhibit, as reducible to demonstration in a distinct proposition) of two equally palpable infirmities that subsist in the definitions themselves; one in the ordinary definitions of the straight line, and the other in the definition of a plane surface. Proof, as it would seem, may justly be demanded that there can be lines of such a property that two cannot coincide in two points without coinciding throughout—or, as the axiom shapes it, cannot "enclose a space." Neither can the adopted "shortest distance between two points" relieve LEGENDRE's system; for, although most evidently there is a "shortest distance" in *amount*, yet what geometer, unless a very late one, has shown that there is but *one specific path* in space to which that least amount can be attributed. Again, in what estimation shall the exact reasoner hold the ordinary definition of a plane? It would indeed be admissible, supposing a straight line properly defined,

to describe that species of surface to be one which can contain all lines that can pass through a given point to cut a given straight line indefinitely produced; but how is it to be ascertained, that any two points not in that given line being taken in that surface, the line joining them shall cut the lines between, that lie in and define the surface?

The undeniable existence of these defects, in addition to the vexed one of parallels, gives dignity and value to an attempt of Mr. T. Perronet Thompson, of Cambridge University, in England, in his "Geometry without axioms," to deduce the elementary properties of the straight line and plane from the sphere alone. The same author has discussed with much sagacity, in his appendix, the methods and devices,—about thirty in all,—which, during the historical period of the science, have been proposed to obviate or evade the difficulty relating to parallelism; and he has exposed, with a clearness seemingly incontestible, fallacies in each. Mr. Thompson has also propounded, in his text, a series of propositions which purport to compose a rigorous proof of the entire doctrine; and this, not improbably, with justice; but the prolixity of the process is sufficient, in some instances, to deter one, for the moment, from pursuing it through the somewhat intricate figures.

The author who has made the most persevering and repeated endeavors to complete the doctrine of parallels—supplanting certain of his earlier methods by new ones, and pertinaciously maintaining to the last the rigorous character of others—is the celebrated Legendre. The *conception* of the method first given in the twelfth edition of his Geometry is very elegant; as also its execution in all those steps which are rigorous, and by which it is in fact demonstrated, that if a triangle be given, there may be constructed another triangle having its three angles equal, in their sum, to the sum of the three of the original triangle, and two of its angles less than any assigned angle. Hence it was inferred that by the repeated bisection of one of the angles at the base, the whole triangle may be considered as coinciding with its base, and the exterior angle as less than any angle assigned. The weakness of the conclusion is found in this,—that, since the sides containing the continually bisected angle increase *pari passu* with the diminution of the angle, the apex of the triangle may, for aught that appears, be of any assignable length, and *may* be competent, therefore, to subtend an assignable angle.

With respect to the *analytical* proof proposed by the same author, based upon the theory of functions and the principle of homogeneity, I should have called it hardihood to defend its conclusiveness against the undeniable objection of Prof. LESLIE, that the identical argument by which LEGENDRE attempts to show that the third angle of a triangle is determined by the other two, would show that the third side is also determined alone by the other two, had not the attempt to defend its conclusiveness been made both by its author and by men in the same rank of talent. To what has been written on that subject, I may be permitted, perhaps, to add one or two brief inquiries, as follows: First, how conclusive so ever the proof in question may appear to analysts of a certain practiced and subtle penetration, yet, inasmuch as the purpose of a *demonstration* is to manifest truth to those who are in the capacity of being taught, can it be demanded of *ordinary reasoners* to conclude that, because two triangles having two equal angles adjacent to one equal side would coincide, and have their third angles equal, that, therefore, if the side were varied, *the other two sides would meet as before;* and, moreover, that the third angle in this and the former triangles would be *one and the same function* of the side and the angles adjacent to it,—that is to say, that there is *some specific arithmetical process* by which the third angle may be deduced from the three quantities or elements named? All this, however, is demanded in the outset of the proof under consideration. Again: it will be conceded, I presume, that no property *peculiar to straight lines* can be demonstrated without the introduction *somewhere* in the proof, either explicitly or implicitly, of at least one step dependent on some property known, either by definition or by antecedent evidence, to pertain exclusively to such lines. My second question, therefore, would be, what one step of the so called analytical argument embodies any such peculiar property?

Among LEGENDRE's methods of proof, there is one proposed in a note to Prop. XIX, of the 12th edition of his Geometry, which depends upon the equal division of an infinite plane by an infinite straight line, and the consequent necessity inferred in the argument, that a straight line contained in an angle must, if produced, eventually meet the containing sides (one side it should be) of the angle. But the argument, as Mr. T. P. THOMPSON in his examination has pointed out, equally proves that two parallels can not

exist,—and for this reason, probably, it may be that LEGENDRE himself, in his ultimate and general memoir on the subject of parallels contained in Vol. XII, of the "Mémoires de L'Académie Royale," has made no account of that method. Had the argument, however, turned upon the comparison of the contained angular space with the exterior space in the way of *ratio*, instead of *absolute excess or defect*, (as it will be obvious to all familiar with that argument that it might have been made to do by continually bisecting the interior angle until a part should be found less than the excess of the whole exterior over the interior,) the proof would have rested unapproachable by the objection named. The only possible doubt would then have been whether the space on the side of the contained line opposite to the angular point is certainly a part of the interior angular space alone; yet that it must be such is, if not perfectly axiomatic, at least so nearly axiomatic as to give to this simple method, so modified, in my own apprehension, at least, a superiority over all others, including those of LEGENDRE himself and the *suspicious* although certainly simple and specious method of BERTRAND.

But, not to prolong discussions and comparisons beyond the demands of my immediate object, I pass to the development of an attempt of my own by which I propose to complete the doctrine of parallels and to make the *postulatum* of EUCLID independent, in fact, (in the simple case in which one of the interior angles made with the third or cutting line is a right angle) of any antecedent proposition.

To this end I employ a particular relation—whether positively or negatively assumed in hypothesis—of lines containing an angle to the angular space; which relation, or *possible* relation, if that qualification should be insisted on, appears not to have been heretofore reflected upon, or even noticed for any purpose of demonstration or investigation,—and which constitutes, therefore, if I err not in my application of it, a novel element of geometrical reasoning; notwithstanding that I am not able to determine what other than the special applications I shall make, it may be expected to be susceptible of. The element or relation referred to is nothing more than the truism that, if two straight lines meet, either of them *belongs* or does *not belong* to—or (if that phraseology be preferable) *is* contained or is *not* contained by—the angular space bounded by the lines, and consequently, would be con-

tained either by *both* or by *neither* of two such precisely similar spaces on opposite sides of the line. This is an assertion intelligibly true, without the requirement of any subtleties or even any conjectures as to the proper choice of sides in the alternative; but our argument, as will presently be seen, allows the objector to be dogmatical as to the one side or the other, or to stand in hesitancy between the two. But, if any one should deem it an additional satisfaction to conceive, with the utmost precision, what is intended by the expression "a line belonging to or contained by an angular space," I may, without involving the merits of the argument in any specific definition of which it and its fundamental principle are independent, explain my individual conception of the interpretation, which, moreover, I suppose to coincide with that interpretation and idea that would spontaneously suggest itself to a mind imbued with even no more than the most elementary geometrical conceptions. Every geometrical magnitude is a definite extension. A sphere, for example, which is given in dimensions and fixed in position, occupies, throughout its entire extension, *place* or *position*,—that is to say, throughout the whole, *points* may be taken,—and those *belong to* or *are contained by* the sphere. The same is true of points of an angular space, and, by consequence, of a line of the same. The idea, like the idea of *distance*, is simple and plain, and, like that, capable of being *referred to* and *recognized* but scarcely of being made plainer by definition.

If, however, any one should suppose, that a line which belongs to or is contained by an angular space must have a portion of that space on both sides of it, the reader can judge, after becoming possessed of the argument, whether, even in the sense of such a definition, he can deny my principle, as above stated, or subvert its conclusive application. Yet such a definition does, in effect, deny that a magnitude occupies *place* up to its extreme boundaries. A better definition would be, that the contained line must be *between* the bounding lines of the angular space; but this would compel the definer to adopt the *negation* of our alternative,—so as to begin, not like our argument, "the line *does* or does *not* belong," &c., but, "the line *does not* belong," &c.

One caution only is requisite to bespeak a due appreciation of the chain of proof I am about to offer. Lest the reader might, in the outset, enter upon it with a presumption that from such a truism as that above stated, no conclusion, and none, especially,

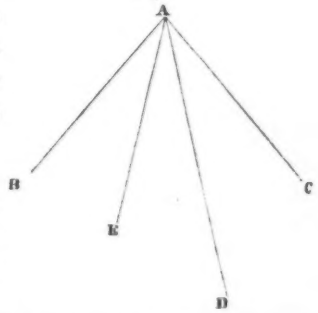
which has baffled the skill applied to it in so many forms, can legitimately spring, I would propose the inquiry whether, in case some one of the more recondite truths of geometry—as, for example, the ratio of a sphere to its circumscribing cylinder—should, by a flash of reasoning and through a brief step or two, be connected with the ordinary and unexceptionable definitions, the latter might not, just as unavoidably, seem inadequate to contain or give origin to such a conclusion as the former?

PROPOSITION.

Two straight lines which make, with a third line that cuts them, the two interior angles together less than two right angles will meet, if indefinitely produced.

Demonstration.–Let the straight line AD (fig. 1) divide the angle BAC; and, if it divides it unequally, cut off from the greater part, as DAB, an equal, DAE, to DAC the less.

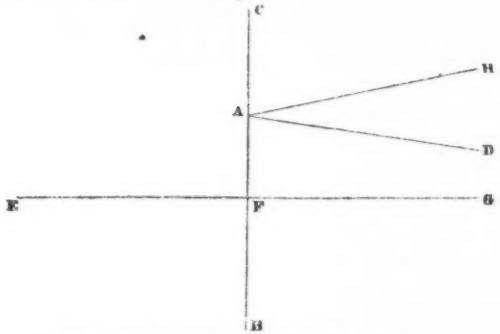
Fig. 1.



The straight line AD either belongs to, or, in other words, is contained by the angular space DAC or it is *not* contained by it. And if, by the nature of an angular space, it *is* contained by DAC it must evidently be, in like manner, contained by DAE; and if *not* contained by DAC it is not contained by DAE; but, if contained by DAE, the construction of an adjoining angle EAB cannot affect that fact nor, *mutatis mutandis*, the contrary. We therefore see that, if a line divides an angle, it must be contained by both parts or by neither,—so that either the two coincide in that line or are separated by it. On whatever condition, therefore, an angle, as DAC, shall have been constituted, (as, for example, by drawing AD and AC through fixed points,) it is not allowable to constitute an adjoining angle DAB on such a condition as shall exclude AD from either being contained by both angular spaces or else, by neither.

Let then EG (fig. 2) be an indefinite straight line, and A a point without it. Let AB be a line cutting EG at right angles in F, and produce BA to C.

Fig. 2.



Let the angle BAD be constituted by the condition that it can contain all the lines drawn through A that can meet FG infinitely produced on the one side of CB towards G. Then I say that the angle DAC cannot be constituted simply on the condition that it can contain all the lines that will *not* meet FG produced as before; for, then, whether AD be contained by *both* BAD and DAC, or by *neither*, it must meet and not meet FG at the same time; which is absurd. In searching, therefore, for the proper constitution of the angle DAC, we observe that, if some point, as E, on the other side of BC from G be united with A, and the line be produced, that line will lie in the angular space DAC; also, if a line be drawn at right angles to CB through A, it will not meet on either side; for if it be supposed to meet on one side, then, for the same reason, it must meet on the other; which is impossible.

There subsists, therefore, a threefold distinction in the lines that can be drawn in the entire angular space on the one side of BC towards G; first, lines that can meet the line EG on *that one side;* second, lines that can meet the same on *the other side;* and third, a line or lines that can meet on *neither side;* also, it is evident, that in relation to meeting EG, these *are all the distinctions that can subsist.*

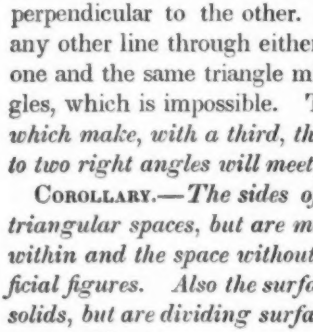
If, now, there can subsist more lines than one through A that meet on neither side, let the angle CAH be constituted so as to contain all that can meet on the other side from G, and of course, HAD must contain all that can meet on neither side. Now if AD *is* contained by BAD, it is also contained by DAH,—that is, it meets on the one side, towards G, and on neither side at the same

time; which is absurd. But if AD is *not* contained by BAD it does not meet on the one side towards G,—yet it cannot (by what was proved at the first) be contained by DAH, and therefore *must* meet on the one side or the other, and therefore, since that is not on the one side towards G, it must be on the other towards E: therefore, AD is contained by the angular space HAC, from which it is separated by the angular space HAD; which is impossible. Therefore there cannot be any such angular space HAD; but AH and AD must coincide, and there can be but one line through A, that does not meet EG on either side, and that, as has been shown, is the line at right angles to CB.

Now it is well known that if a line cut two others so as to make the two interior angles together equal to two right angles, and if the cutting line be bisected, and from the bisecting point a perpendicular to one of the two lines be drawn, it may be and is proved perpendicular to the other. But it cannot be perpendicular to any other line through either extremity of the cutting line—else one and the same triangle might have two angles both right angles, which is impossible. Therefore, *any other lines than those which make, with a third, the two interior angles together equal to two right angles will meet, if indefinitely produced.*

Corollary.—*The sides of triangles are not contained by the triangular spaces, but are mere dividing lines between the space within and the space without. Also the same is true of all superficial figures. Also the surfaces of solids are not contained by the solids, but are dividing surfaces between the space within and the space without.*

Fig. 3.



For let ABC (fig. 3) be a triangle. Produce BA to D. Now if the only *actual* distinction that subsists among all the lines passing through A, with reference to the limited line BC, is that lines of one class *meet* or *intersect* it and those of another do *not*, we have, on the one side of BD towards C, the angle BAC constituted or defined as that which can contain the *first* only, and the angle CAD as that which can contain the *second* only. Whether, therefore, the line AC is contained in both angular spaces or contained in neither, the absurdity arises that it must intersect and

not intersect at the same time. A threefold distinction must, therefore, actually subsist, namely, lines that intersect BC, lines that do not intersect it, and a peculiar line limiting the two, or dividing between the spaces that can contain them; and which, with reference to the line BC, may not improperly be said to *touch* it in C.

The same may, in like manner, be proved respecting any rectilinear figures whatever. But if a figure be curvilinear, it may be circumscribed by a rectilinear figure whose boundary shall touch the curvilinear at any given point; or in other words, may coincide with the curve at that point. Then the curvilinear figure *at the point of coincidence*, is separated, equally with the rectilinear, from the spaces without, by the right line which contains the one given point, which point, therefore, belongs to neither the space within nor the space without, but to the boundary. Therefore any point whatever of the curve does not belong to the curvilinear space; which consequently is, as in the former case, a dividing line.

Lastly, if a solid be cut by a plane, there is a sectional figure which is constituted by all that is common to the plane and the solid, and no more. But the boundary of the section has been proved not to belong to its superficial extension and therefore does not belong to the solid. But it is the section of the solid's boundary by the plane which constitutes the boundary of the figure, and therefore the boundary of the solid does not, *at this line*, belong to the solid; and the same may be proved at any point whatever in the surface of the solid.

Scholium.—Besides the evidence which the principle and manner of reasoning employed above carry in themselves, there are two incidental *symptoms* or *indexes* of genuineness. One is that the resulting truth in relation to a parallel, is made to depend, *as it ought to depend*, upon a property of the infinite straight line in distinction from the finite. Thus, in comparing the proposition and the corollary, we find that the line AC in the latter cannot exist under the conditions of the former, because beyond every such line others may be drawn intersecting the indefinitely produced line. The other is that the truth of the corollary is deducible, at least in a partial case, by a method quite independent of its own argument. For if, in fig. 1 of the proposition, the angular space DAC, instead of being defined as that which *can con-*

tain certain lines, be defined as that which shall contain or be *full of* some physical substance, gold for example, while the adjoining angular space DAB, be defined to be full of some other, as silver, it is plain at once that the line AD is simply a dividing line between the gold and the silver. And—demonstration aside—reflection will perhaps make it apparent that an abrupt transition from that which can contain the lines of one specific property to that which can contain the lines of an opposite or distinct property, can no more take place, except through a *peculiar or dividing line*, than from that which is full of gold to that which is full of silver.

It is essential to observe farther, a twofold, but obvious requisite as to the distinctions that can be employed. First, they must not be *arbitrary*—that is to say, such as either *have no pertinence to the point at issue*, or *do not define the spaces:* Second, a specific distinction being once established as a basis of the argument, *no correlative or homogeneous distinction that can subsist must be overlooked.* Thus, in the corollary, if BC be produced and an angle adjoining BAC be constituted as that which can contain all the lines that will intersect *beyond* C, reason shows two correlatives, neither of which may be neglected, so that the three will stand, *beyond* C, *at* C, *and on this side of* C.

Finally, in the application of our elementary principle or *relation* to analytical geometry, the correlative distinctions of lines in a given case will be perceived to be threefold, manifold or even unlimited, according to the conditions of the application. In the case of lines through a point without a circle they would be threefold—lines that cut the circumference, lines that touch and lines that are capable of neither—or, otherwise they might be, lines that cut in *two* points, in *one*, and in *no* point. In the case of curves with different branches they might be manifold, and in that of a spiral cut by an unlimited straight line they must of necessity be unlimited. Whether, in any of the possible applications, valuable truths, other than the two I have developed, would be the result, there has not yet been opportunity sufficiently to consider.

Middlebury, June, 1845.

[For an editorial note to Prof. TWISING's article, see p. 147 of this No.]

SCIENTIFIC INTELLIGENCE.

I. Chemistry.*

1. *Researches upon the Phenomena that attend the Projection of Bodies upon Hot Surfaces;* by M. Boutigny, (Ann. de Chim. et de Phys., Vol. ix, p. 350, and Vol. xi, p. 16.)—Notice would have been taken of these researches before, had it not been from a desire to present a review of all of his memoirs at one and the same time; the third has not yet appeared, but the results already obtained are too interesting to remain longer unnoticed.

The peculiar phenomenon that a drop of water or other liquid presents when thrown upon a red hot surface, that is to say, of assuming a spheroidal form and evaporating but slowly, has been known for a very great length of time, but has never been critically studied. The author has endeavored to determine

1st. The ultimate limit of temperature, at which this phenomenon takes place.

2d. The law of the evaporation of water in its spheroidal condition.

3d. The temperature of the liquids in their spheroidal state, as well as that of their vapors.

4th. If the radiated caloric traverses the spheroids or is reflected.

5th. If all bodies can pass to the spheroidal condition.

6th. If there is contact between bodies in their spheroidal condition and the surfaces upon which they are formed.

7th. If this phenomenon plays any part in the explosions (*fulminantes*) of steam boilers.

The first, concerning the limit of temperature at which the liquids become spheroidal, was determined by the following experiments among

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* Dr. J. Lawrence Smith, of Charleston, (S. C.,) who is already well known to the readers of our first series as an able chemical contributor, has kindly consented to continue his labors under this head in the present. His abstracts will always be followed by his initials, to distinguish them from our own,—as those of Dr. Gray in botanical science and bibliography, are known by "A. Gr." It is our intention to follow closely the progress of the various departments of science at home and abroad, by giving condensed abstracts of all that is most interesting and valuable to American readers, diligently culled from the foreign journals, and presented in a readable form at the earliest possible moment. To effect this, we are in the regular receipt of all the most valuable European journals of all languages, besides having the kind aid of several gentlemen eminent in their several departments.

We shall follow the general order of—I. Chemistry. II. Mineralogy and Geology. III. Zoology. IV. Botany. V. General Physics.—*Eds.*

others. A drop of water was thrown into a polished silver capsule heated to 392° FAHR., then carefully transferred to an oil bath heated to 302° FAHR., and the water was found to maintain its spheroidal condition until the temperature of the bath descended to 288° FAHR.; then it moistened the surface and evaporated rapidly. This then has been found to be the lowest temperature at which water maintains the spheroidal state. If the quantity of water consisted of several drops, its *sphericity* was lost at 308°. It has been ascertained that the lowest point at which alcohol and ether retain the same form, bears the same proportion to their boiling point, as 308° does to the point of ebullition of water,—it being 272° for alcohol, and 142° FAHR. for ether. Anhydrous sulphurous acid does not follow this law, but it is not an easy substance to experiment with; it however assumes and retains the spheroidal condition much below the boiling point of water, which is ascertained by placing a capsule in boiling water and letting the acid fall into it; a large quantity may thus be made to assume the spheroidal shape, but it soon becomes hydrated in absorbing and congealing the watery vapor; thus we have the singular phenomenon of the congelation of the vapor of water in boiling water.

These facts establish that *the temperature necessary to cause a body to pass to the spherical state, is higher as its boiling point is greater.*

The next series of experiments were to ascertain the law of the evaporation of the water while in its spheroidal condition. At 392° FAHR. a grain and a half of water took 3·30 minutes to evaporate; at 752°, the same quantity of water was evaporated in 1·31 minutes; at a dull red heat, in 1·13 minutes; and at a bright red, in 0·50 minutes,—*the evaporation increasing with the temperature*, which is contrary to the rule laid down by KLAPROTH on the subject; but the experiments of the latter were made in iron vessels, and the oxidation of the metal interfered with the accuracy of the results. As regards the temperature of the body while in the spheroidal condition, the author has established the following general rule: *bodies in their spherical condition remain constantly at a temperature lower than that of their ebullition, without regard to the temperature of the containing vessel,*—

That of	Water being	206° FAHR.
"	Absolute alcohol, . . .	168° "
"	Ether, ...	109° "
"	Chloric ether, . . .	51° "
"	Sulphurous acid, . . .	13° "

M. BOUTIGNY has been the first to experiment with sulphurous acid thrown on hot surfaces, and his results are exceedingly interesting. Heat to redness a platinum capsule, and pour into it several grammes of anhydrous sulphurous acid. On observing that part of the glass

from which the sulphurous acid is let drop, and opposite to the hand, it is seen to boil rapidly, which ebullition ceases instantly as it falls into the red hot capsule, and its evaporation goes on with an incredible slowness and without any signs of ebullition. If the weather be damp, the acid becomes turbid, and finally loses its transparency, then solidifies, and upon examination the solid is found composed almost entirely of water. If the weather be dry, then no residue is left. The singular phenomenon, of boiling sulphurous acid becoming colder when thrown into a red hot capsule, is not peculiar to it, as boiling water will exhibit the same fact, falling from 212° to 206° Fahr.

If we throw distilled water drop by drop into sulphurous acid in the spheroidal condition, it becomes frozen, even if the capsule be *white hot;* or if we plunge for about a half a minute a small glass bulb containing about fifteen grains of water into sulphurous acid in the spheroidal condition,—withdraw it, and break it, and a small lump of ice will be found within. A still more striking way of making the experiment, is to place the capsule containing the sulphurous acid, at the bottom of a muffle in a furnace heated to whiteness, when if the weather be dry, the evaporation goes on slowly without any residue,—if the weather be moist, ice will remain behind. Again, if a brick be placed upon the plate of an air-pump, around it a layer of binoxide of lead to absorb the acid vapor, and upon that a piece of brick heated red hot, having a cavity that contains a small capsule, into which sulphurous acid is poured, and a vacuum be rapidly produced; the sulphurous acid which ought, so to speak, to explode, does not boil, but evaporates slowly, just as in a white hot capsule, or as at the bottom of the muffle of the furnace; and what is still more remarkable is, that on a damp day the little water that the air of the receiver contains, congeals in the spheroidal sulphurous acid: all other liquids behave in the same way in the vacuum.

The vapors arising from the spheroidal liquids, have their temperature much elevated; and where water and an iron vessel is used, it is decomposed, furnishing hydrogen gas.

Does the heat traverse the liquids in their spherical condition without combining, or is it reflected? This is important to determine, for up to the time of M. Boutigny's experiments, it was pretty generally admitted that it did traverse them; but he has proved most clearly that the heat is *reflected* and not transmitted. A platinum capsule was made red hot, and by means of a support, a small glass bulb containing water was placed very near the bottom of the vessel; the radiated heat soon heated the vessel, and made the water boil; it was now withdrawn, and water poured in, when it immediately assumed the spheroidal condition, and into it was plunged the small bulb before alluded to; but no

signs of ebullition manifested themselves, showing clearly that no calorific rays penetrated the spheroid of water. Nor is this result at all affected, if small particles of wood, sand or iron be mixed with the water; and the iron, although so much heavier than the water, will not touch the capsule, but remains in the spheroid until its complete evaporation. If lampblack be mixed with the water, and into it the small bulb of water be plunged, no difference is seen from the former case.

Can all bodies pass to this spheroidal condition? From the author's experiments, he concludes that all bodies *can* pass to this state.

The experiment with iodine is brilliant, and can be easily repeated in a lecture room. Throw in about fifteen grains of iodine into a capsule (almost flat) heated to redness, when it at once assumes the spheroidal condition, and is surrounded with rare and transparent vapors of iodine; withdraw the source of heat, and in a moment after the iodine passes to its ordinary liquid state, moistens the capsule, boils with violence, and gives rise to an abundance of most beautiful vapors. This gives a good idea of the difference existing between the evaporation of a body in its spheroidal condition, and the evaporation of the same body by ebullition.

Experiments were made to ascertain whether the heated surface was touched or not. It is discovered that *the surface is not touched by the bodies in the spheroidal condition.* This was proved in various ways; among others, by placing a drop of water upon an almost flat capsule, (heated,) and on looking at a lighted candle placed at one side of the capsule, it can be seen perfectly without interruption between the capsule and spheroid.* J. L. S.

2. *New Chloride and Oxide of Chrome;* by E. Peligot, (Compt. Rend., Sept. 1844.)—Pass a current of chlorine gas over a mixture of oxide of chrome and charcoal heated to redness, and minute white silky crystals appear, composed of 1 equiv. chrome and 1 equiv. chlorine; it is a degree of oxidation of chrome till now unknown, corresponding to CrO. This chloride becomes green upon exposure to the air, absorbing at the same time the moisture; added to water it immediately dissolves, and imparts to it a green color, if the water happens to contain air, and blue, if the influence of oxygen is avoided; potash gives with this solution a brown precipitate, which is the protoxide CrO. Acetate of potash added to the solution, gives rise to a slow deposition of red transparent crystals, the acetate of the protoxide. It is necessary to take every precaution, in order to obtain these substances pure, so powerful is their attraction for oxygen.† J. L. S.

* The remainder of the notice, already sufficiently extended, will be furnished at another time.

† It will be seen that the process given by M. Peligot is the same which has

3. *Atomic Weight of Iron*, (Journ. für Prakt. Chem., xxxiii, p. 1.) —The atomic weight of this metal has lately been the subject of investigation by SWANBERG, NORLIN, BERZELIUS, ERDMANN and MARCHAND, and all agree by different methods in making it 350, oxygen = 100 or 28, hydrogen =1. This is nearly 1 greater on the hydrogen scale than that adopted in the recent works on chemistry by KANE, GRAHAM, &c. J. L. S.

4. *New Metals.**—There have been three new metals lately discovered,—*Pelopium*, *Niobium* and *Ruthenium;* the first two were procured from the Bavarian Tantalite by Prof. H. ROSE, and the latter was found associated with the ore of platinum by Prof. CLAUS. Pelopium and Niobium exist in the mineral under the form of Pelopic and Niobic acids. (Comptes Rend., Dec. 1844.) They resemble the tantalic or columbic acid so closely in all their properties, that it becomes difficult to separate them from each other. Prof. ROSE has however obtained the Niobic acid perfectly pure, and the greatest difference between it and columbic acid appears to be, that it forms when heated with charcoal and chlorine, a chloride that is colorless, infusible and very slightly volatile, whereas the tantalic acid affords a chloride yellow, very fusible and volatile.

The Niobium is readily obtained in its metallic state, by submitting the chloride to the action of dry ammonia, and applying heat, when the metal is reduced with the disengagement of the hydrochlorate of ammonia.

The Ruthenium discovered by Prof. CLAUS, (Chem. Gazet., Feb. 1845,) as already stated, is associated with native platinum, and is procured from what is called the platinum residue, (the residue after treating the platinum ore with nitromuriatic acid.) It is first fused with nitre at a red heat for about thirty minutes, and the fused mass treated with water and dilute acids, which extract the osmium and iridium; the solid matter left is now fused with its own weight of nitre, and kept at a white heat for two hours; the mass is taken out, while still red hot, with an iron spatula, and after cooling reduced to a coarse powder, which is extracted with distilled water; so soon as the water becomes clear, it is decanted. It contains rutheniate, chromate and silicate of potash. Nitric acid is added cautiously, until the alkaline reaction has disappeared; by this means, oxide of Ruthenium and potash, and some silicic acid, are precipitated, as a velvet black powder; after

been heretofore used for the production of sesquichloride of chromium, during which process the compound now first noticed by M. PELIGOT is also formed, and being mixed with the sesquichloride, has given rise to the discordant statements which have been made regarding this substance.—*Eds.*

* See Vol. XLVIII, p. 400, of this Journal, for some previous notice of these metals.

washing this powder, it is dissolved in muriatic acid, evaporated until the silica separates as a gelatinous mass; it is then diluted with water and filtered. It must not be evaporated to dryness for the more complete separation of the silica, because the chloride of Ruthenium is thereby decomposed into an insoluble protochloride. The filtered solution, which is of a beautiful orange yellow color, is evaporated down to a very small volume, and mixed with a concentrated solution of chloride of potassium, when the salt $KCl+RuCl^2$ separates in reddish brown crystals. J. L. S.

5. *New Acid in Human Urine*, (Chem. Gaz., Nov. 1844, p. 479.)—W. HEINTZ has obtained a minute quantity of a new acid from fresh human urine; it contains nitrogen, and differs from hippuric acid. Its properties have not yet been fully investigated, nor is there any name given to it. J. L. S.

6. *Atomic Weight of Zinc;* by M. A. ERDMANN, (Pogg. Ann., lxii, p. 611, and Chem. Gaz., Jan. 1845, p. 14.)—It was determined by ascertaining the amount of oxygen absorbed by a given weight of pure zinc. The number furnished by this method is 406·591, oxygen being 100. This is 3·365 higher than that admitted by GAY LUSSAC, and 7·409 lower than that announced by JACQUELIN. J. L. S.

7. *Researches upon the Metallic Acids;* by M. FREMY, (Ann. de Chim. et de Phys., Nov. and Dec. 1844.)—It would be impossible to give here any thing like a sketch of these elaborate and highly interesting researches; all that can be done is to state the principal facts discovered by the author. The capacity of saturation of aluminic acid was determined by forming a crystallized aluminate of potash, which ought to be considered a neutral salt; an analysis of it, showed that the oxygen of the acid is to the oxygen of the base as 3 to 1. The *ferric acid* was discovered by M. FREMY, (FeO^3), and is prepared by a method already well known to chemists; but the one preferred by M. FREMY, will be mentioned in these abstracts. It was found that chlorine, passed over chromate of potash heated to redness, furnished beautiful crystals of oxide of chrome; it is an easy process. The *protoxide of tin* was obtained under different forms, brown, black and red. Two modifications of stannic acid were discovered, both having the same composition, but requiring different amounts of bases to form neutral salts; the acids are called stannic and metastannic. Bismuth was found to form an acid with oxygen, Bi^2O^4. The peroxide of lead, PbO^2, formerly thought to be indifferent, turns out to be a true metallic acid, combining with the various bases. The plumbate of potash is remarkable for its beautiful crystalline forms. By treating this last salt with a solution of the protoxide of lead in an alkali, hydrated minium is formed by double decomposition. Copper forms with oxygen an acid,

which is very unstable, containing more oxygen than the deutoxide. The author's researches upon osmium and iridium have already been alluded to, as was the new osmious acid, OsO^3. J. L. S.

8. *Potash and Soda;* by M. Bizio, (Chem. Gaz., 1845, p. 46.)—This author recommends a new method of rendering these alkalies caustic. It is to mix one part of the carbonates in solution with one part of freshly prepared dry hydrate of lime, and allowing it to stand in a closed vessel for twenty four hours, at a temperature of 68° to 78° Fahr., frequently shaking it. The potash should be dissolved in 12 to 15, and the soda 7 to 15 parts of water. The carbonate of lime separates in a granular state, and the caustic ley may be decanted; a weaker ley may be obtained from the residue, by fresh treatment with water. J. L. S.

9. *Prussic Acid;* by M. Witting, (Chem. Gaz., Jan. 1845, p. 47.)—It is recommended to mix the matter taken from any one supposed to be poisoned by this acid, with one sixth its weight of alcohol, and distill over one fourth. If prussic acid be present, the distilled product generally evolves the peculiar smell; to the product a little caustic potash is added, and then a mixed acid solution of the protochloride and perchloride of iron, when prussian blue is formed. If the poisoning was effected by any of the cyanides, hydrochloric acid should be added along with the alcohol. J. L. S.

10. *New Test for Bile and Sugar;* by Dr. M. Pettenkoffer, (Ann. der Chem. und Pharm., Oct. 1844.)—This test is based upon the deep violet tint afforded by the addition of sulphuric acid and sugar to the bile, even when perfectly colorless. It is upon the choleic acid, (which forms the essential part of the bile,) that this reaction takes place. A little of the liquid suspected to contain the bile is poured into a test tube, and two thirds of its volume of sulphuric acid added by drops, so as not to allow the temperature of the mixture to exceed 144° Fahr., as a higher temperature would decompose the choleic acid; then add from 2 to 5 drops of a solution of one part of sugar to four fifths of water, and shake the mixture; if bile be present, the violet red color will appear in a shorter or longer space of time, according to the quantity present. The precautions necessary to succeed are, not to allow the temperature to exceed 144° Fahr.; not to add too much sugar; the sulphuric acid must be free from sulphurous acid. If albumen be present in the suspected liquor, it is best to coagulate it previous to testing, with a little alcohol or heat. If the bile be in small quantity, it should be concentrated in a water bath, extracted with alcohol, and this last evaporated to a small bulk, and the test applied to the solution when cold; this is particularly to be attended to, when the urine and other secretions are the subjects of experiment. By means of this test, bile was detected in the urine of a patient suffering under pneumonia. The

fæces of a healthy man when extracted with spirits and tested, did not show any indication of the presence of bile, whereas in adding a little bile previously to the fæces, the test did not fail to indicate it. In all cases of diarrhœa bile is found in the stools,—so after the administration of calomel and other purgatives. This test reversed, may be used for the detection of sugar, that is to say, a mixture of bile and sulphuric acid is first made, and the suspected liquid added; if sugar be present, the violet red color will appear. This is a ready way of testing diabetic urine.

To test the blood for bile, the albumen is first separated by boiling with alcohol, and the concentrated solution tested as already mentioned.

J. L. S.

11. *Ferrate of Potash;* by M. Fremy, (Ann. de Chim. et de Phys., Nov. 1844.)—After numerous experiments upon this salt, the author points out the following methods as the best for obtaining it. Surround a Hessian crucible with burning charcoal, and introduce 80 grains of pure iron filings; as soon as these are red hot, throw upon them 160 grains of pulverized nitre that has been fused; the action is instantaneous and violent. After allowing the crucible to cool, a reddish violet mass remains, containing a large quantity of ferrate of potash, with a little of the peroxide of potassium that becomes decomposed when mixed with water. The iron must not be heated too long before the addition of nitre, as the coat of oxide formed prevents the reaction. Another way proposed, is to pass a current of chlorine gas into a concentrated solution of potash, containing hydrated sesquioxide of iron in suspension; the liquid soon acquires a purplish red color, and the oxide is dissolved. When the potash is in great excess, a blackish powder is precipitated, which is the ferrate of potash, that has mixed with it a considerable quantity of chloride of potassium; to purify it, it is redissolved, and precipitated by a concentrated solution of potash. It must be dried on absorbent pieces of porcelain. The dry salt should be quickly inclosed in tubes hermetically sealed, as the moisture of the atmosphere decomposes it. J. L. S.

12. *Separation of Oxide of Cobalt from the Oxide of Manganese;* by M. Clöz, (Jour. de Pharm., Feb. 1845.)—This is done by treating a neutral solution of the two oxides with an excess of the persulphuret of calcium or potassium, which dissolve the sulphuret of cobalt formed, the sulphuret of manganese remaining undissolved. This method is particularly well adapted to cases where the quantity of the oxide of cobalt present is very small. J. L. S.

13. *Ashes of Human Blood and Saliva*, (Chemist, Feb. 1845, p. 88.)—One hundred parts of the human blood contain—

Tribasic phosphate of soda, . . .	22·100
Chloride of sodium, ...	54·769
Chloride of potassium, ...	4·416
Sulphate of soda, ...	2·461
Phosphate of lime, ...	3·636
Phosphate of magnesia, ...	0·769
Oxide of iron with phosphate of iron, . .	10·770

One hundred parts of the ashes of the saliva contain—

Tribasic phosphate of soda, . . .	28.122
Chlorides of sodium and potassium, . .	61.930
Sulphate of soda, ...	2.315
Phosphates of lime, magnesia and iron, .	5.509

J. L. S.

14. *Separation of Tin from Antimony;* by A. Levol, (Ann. de Chim. et de Phys. Jan. 1845.)—If these two metals be in the form of an alloy, reduce to a thin plate, and heat with hydrochloric acid; after boiling for a few minutes, add chlorate of potash in small quantities at a time, until all the metal is taken into solution; now precipitate the metals with a bar of pure zinc, which must be withdrawn after this operation is completed; and then add a portion of concentrated hydrochloric acid about equal to the quantity first employed—this is done without removing the chloride of zinc—the whole is now boiled, and the tin is re-dissolved entirely at the expiration of about one hour, the antimony remaining in the form of a fine black powder, which may be collected on a filter and weighed; the tin can now be precipitated by sulphuretted hydrogen. J. L. S.

15. *Formation of Lactic Acid from Cane Sugar;* by Prof. H. Von Blucher, (Chem. Gazet. Ap. 1845, p. 151, and Pogg. Annalen, Vol. lxiii, p. 425.)—It was formed by fermenting a solution of sugar with well washed caseine, and the following is one of the experiments performed—1400 grms. of cane sugar were dissolved in 6000 grms. water, and 400 grms. moist, (containing 94 grms. dry) caseine, and a sufficient quantity of finely pulverized chalk mixed with it, and the whole exposed to a temperature of 77° to 86° Fahr. In the course of four weeks the whole formed a crystalline paste. After one recrystallization, 870 grms. crystallized lactate of lime, were obtained; and the mother-ley somewhat evaporated yielded 162 grms. crystallized mannite. The latter, however, was not perfectly pure, and contained 3·6 per cent. lime, probably in combination with lactic acid. In the liquid separated by filtration from the mannite, there subsided, on evaporation over the water bath, a further quantity of minute

crystals of mannite, which however could not be isolated from the syrupy liquid, and the whole was therefore evaporated in the water bath. The residue obtained in this manner weighed 732 grms. and contained $12\frac{3}{4}$ per cent. lime; 350 grms. of this dry residue was dissolved in 1200 grms. of water mixed with caseine and pulverized chalk, and placed in a warm chamber; in 7 days it had become converted into a crystalline paste, from which were obtained on re-crystallization 210 grms. lactate of lime. If the product of 210 grms. be extended to the entire residue 732 grms., this would have yielded 439 grms. of the salt, consequently the above 1400 grms. of sugar would have produced 1309 grms. of lactate of lime, exclusive of loss. J. L. S.

16. *Acetate of Iron, remedy for Arsenical preparations;* by M. DUFLOS, (Ed. Phil. Mag. 1845.)—It appears from experiment that the hydrated peroxide of iron possesses no efficacy as an antidote where arsenite of potash, (FOWLER'S solution,) or arseniate of potash have been employed; it only acting where the uncombined acids have been used. The author recommends as a substitute in this case, the peracetate of iron, prepared by adding acetic acid of density 1·06 diluted with two or three parts of water, to the hydrated peroxide of iron prepared in the ordinary way, (there should be an excess of peroxide.) This preparation is administered largely, diluted with water, it being thus much more efficacious. J. L. S.

17. *Analysis of the Tungstates;* by M. MARQUERITE, (Comptes Rendus, Feb. 1845.)—To the salt to be analyzed, is added several times its weight of pure sulphuric acid, (in a platinum cruicible,) which is at first heated gently, and gradually raised to a red heat; the residue which consists of an acid sulphate and free tungstic acid, is thrown upon a filter, and washed with water charged with sal-ammoniac, by this means the tungstic acid is prevented from combining with the water and traversing the filter; after the washing is completed, the filter and its contents are ignited and weighed. J. L. S.

18. *Test for Nitric Acid;* by E. G. SCHWEITZER, (Proceed. Chem. Soc. Jan. 1845.)—It became necessary in the examination of the Bonnington mineral water, to test for nitric acid where bromine and iodine were present. It is known that if any fluid, containing even a very small quantity of nitric acid, be concentrated, and mixed with a little pure sulphuric acid, that a concentrated solution of the protoxide of iron when added affords a pink color; when the quantity of nitric acid is greater, the color became brown or black. The effect of this test, (sulphuric acid and protosulphate of iron,) upon salts of iodine and bromine, is to tinge the liquid with the peculiar color of these two substances, but an excess of the protosulphate destroys the colors, which is not the case with nitric acid. The author states that where the

quantity of nitric acid is very small, and that of the iodine predominates, it is necessary to make a comparison within a standard liquid; for this purpose 50 grains of distilled water containing half a grain of iodide of potassium, to which 50 grains of sulphuric has been added gradually, and afterwards 50 grains of a concentrated solution of protosulphate of iron is used; this fluid is of a yellowish tinge. If nitric acid be present, even to the amount of $\frac{1}{3000}$ part, it is made evident by the above test, a brownish color appearing, which becomes more evident to the eye by comparison with the standard liquid just described; when the quantity of nitric acid increases, the color becomes darker. If a bromide be present, instead of an iodide, the nitric acid is ascertained with the same facility, by its imparting a greenish hue to the liquid; 50 grains of pure water, containing half a grain bromide of potassium, to which 50 grains sulphuric acid are added, will indicate $\frac{1}{2000}$ part of nitric acid by the development of a brownish tinge; this being brought about first by the liberation of hydrobromic acid by the sulphuric acid, and the subsequent decomposition of it by the presence of free nitric acid. The presence of organic matter affects the delicacy of this test. J. L. S.

19. *Preparation of pure Phosphoric Acid;* by Dr. Gregory, (Med. Gazet. 1845, and Chem. Gazet. May, 1845, p. 216.)—This author has recommended in his recent work on chemistry, the preparation of phosphoric acid directly from burnt bones; the only difficulty attendant upon it, being the separation of the phosphate of magnesia, which he has advised to do by means of alcohol. This method, however, upon more recent experiments, has proved not to answer, and Dr. G. therefore recommends the following:—Having removed the lime by means of sulphuric acid, and evaporated the filtered liquid, (filtering again if any sulphate of lime separates during the evaporation,) to the consistency of syrup, a few drops of sulphuric acid are added to make sure that no lime remains. Of course if turbidness ensues, the lime has not been completely separated before, and the addition of sulphuric acid, filtration after adding some water, and evaporation must be repeated till the syrupy liquid continues quite clear, when sulphuric acid is added. This liquid now contains only the phosphoric acid, the magnesia, and the excess of sulphuric acid. It is concentrated, heated in a covered platinum crucible until the whole of the sulphuric acid has been expelled, and the residue has acquired a low red heat. On cooling it forms a glass perfectly colorless and transparent, which contains only phosphoric acid and the magnesia of the bones. This glass when boiled with water dissolves rather slowly but completely. When the solution is again concentrated in a capsule of platinum until most of the water is expelled, and the temperature rises to between 595° and 600° Fahr.,

it suddenly while hot, becomes turbid from the separation of a peculiar phosphate of magnesia; at the same moment the phosphoric acid begins to crystallize like granular sugar deposited in honey, a form ascribed by PELIGOT to the bibasic or pyrophosphoric acid. If the same temperature be kept up for fifteen minutes, the whole of the magnesia separates in the form of a powder which is quite insoluble in acids or water; when cold the mass is digested with water, which dissolves the phosphoric acid, leaving the phosphate of magnesia as a heavy, fine, snow-white powder, of a faint silky lustre. The filtered liquid is free from every trace of magnesia, and may be considered as pure phosphoric acid. If the bones contain chloride of sodium a trace of phosphate of soda will remain—in this case the burnt bones after being pulverized, should be boiled with water to remove the chloride. Dr. GREGORY recommends this process as a simple one for obtaining pure phosphoric acid. The phosphate of magnesia formed is a peculiar and anomalous salt. From six analyses Dr. GREGORY deduces the formula $2MgO + 3P^2O^5$, that is, an acid sesquiphosphate of magnesia according to the older notions of phosphoric acid. It is insoluble in water or the acids, boiling nitric acid and aqua regia are almost entirely without action upon it. J. L. S.

20. *New Observation on the Chemico-dynamical action of Platinum;* by J. W. DOEBEREINER, (Annalen der Chem. und Pharm., Feb., 1845.)—Spongy platinum prepared in the ordinary way by heating the double chloride of platinum and ammonia, becomes ignited to redness when moistened with *formylic acid*, and decomposes it into carbonic acid and water, two atoms of oxygen being absorbed. It has no effect upon alcohol or pyroligneous spirit, except an alkali be mixed with them, then the sponge becomes incandescent, and the spirits are decomposed. So that by the presence of an alkali, the platinum sponge acquires the property possessed by platinum black, of absorbing oxygen largely. J. L. S.

21. *On the quantitative determination of Soda, and its separation from Potash;* by Dr. WITTSTEIN, (Buckner's Report, xxxvi, 3, and Chemist, May, 1845, p. 215.)—The two bases are first converted into sulphates, then calcined, weighed, and the sulphuric acid found in them determined by a salt of baryta. On subtracting the acid from the saline mixture, the sum of the quantities of the two alkalies becomes known.

The quantity of *potash* may be ascertained, if we first subtract from the sum of the weight of the two salts, the product obtained by multiplying the weight of the sum of the two bases by the quotient, resulting from the division of the atomic weight of the sulphate of soda by the atomic weight of soda, and then dividing this by the difference resulting, on subtracting the quotient obtained by dividing the atomic weight of

the sulphate of potash by the atomic weight of potash, from the quotient obtained, by dividing the atomic weight of sulphate of soda by the atomic weight of soda.

The amount of soda may be ascertained, if the sum of the weight of the two bases be multiplied by the quotient obtained on dividing the atomic weight of the sulphate of potash by the atomic weight of potash; and from the product thus obtained the weight of the two salts is subtracted, and what is left is divided just as in the case of the potash. It will be best understood when expressed in the following way:

K, the quantity of potash.
N, " soda.
S, " two salts.
b, " two bases.

q, quotient obtained by dividing the atomic weight of sulphate of potash by that of potash.

q', quotient obtained by dividing the atomic weight of sulphate of soda by that of soda.

Thus, $K=\frac{S-bq'}{q-q'}$; and $N=\frac{bq-S}{q-q'}$.

It is evident that q, q' and $q-q'$ are unchangeable quantities, q being equal to 1·84955, $q'=2·28209$, and $q-q'=-0·43254$. An example will render this much clearer. Let us suppose that the two sulphates weigh together 100 grains, the sulphuric acid (determined by baryta) 48 grains; consequently the two bases must weigh 52 grains. To find K, (the weight of the potash,) b (the weight of the two bases) $=52$ we multiply by $q'=2·28209$, and then subtract the product obtained $=118·66868$ from S (the weight of the two salts) $=100$, and divide the rest $=-18·66868$ by $q-q'=-0·43254$, by which 43·15 are obtained. These 43·15 of potash, to be converted into neutral sulphate of potash, will require 36·63 sulphuric acid. N (the weight of soda) can be ascertained by substituting the proper numbers for the letters in its formula, when it will be found to be 8·83, equivalent to 20·17 sulphate, which added to the sulphate of potash, furnish 99·95, the original amount being 100 grains.* J. L. S.

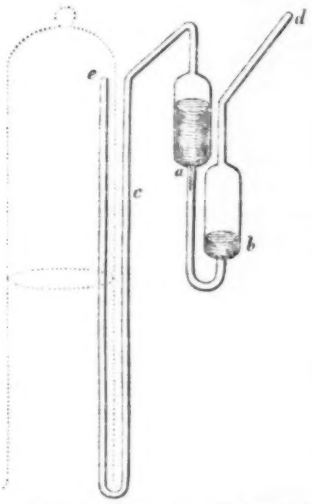
22. *Purifying Arseniferous Sulphuric Acid during its Manufacture;* by A. Dupasquier, (Compt. Rend., March, 1845, p. 794.)—In much of the sulphuric acid prepared from pyrites or from the sulphur obtained from pyrites, arsenic is present in the proportion of from 1 to 1½ thousandths. The author recommends the use of the alkaline sul-

* This method I have found accurate and very easily performed; and if upon more extended experiments its accuracy be found to hold out, the analyst will require no better method. J. L. S.

phurets as a means of purification, (more especially the sulphuret of barium,) during the preparation of the acid. By this means also the nitric acid is necessarily destroyed, an acid occurring in most of the sulphuric acids of commerce. J. L. S.

23. *Observations on an Acid Rain;* by M. DUCRES, (Journ. de Pharm., April, 1845.)—During the early part of June, 1842, a storm occurred in the town of Nismes, accompanied with much thunder and a large amount of hail. From some peculiarity in the taste of the hail, the author was led to examine it more closely. Having collected a quantity of it, and allowed it to melt, it was found to have an acid reaction, which upon examination was found to be due to nitric acid, formed no doubt by the action of electric fluid on the elements of the atmosphere. The occurrence of nitric acid in hail is not new, but the statement of this fact goes to confirm observations previously made. J. L. S.

24. *Gas Pipette;* by Dr. ETTLING, (Ann. der Chem. und Pharm., Jan. 1845.)—This little instrument, easy of construction, will no doubt be found very serviceable for many purposes in the laboratory, as transferring gases from vessel to vessel without disturbing their position. Its construction and manner of operating is very readily understood by referring to the annexed figure. Previously to using the instrument, the extremity *e* is immersed in the liquid over which the gas has been collected, and the cylinder *a* filled by sucking at *d*, after which the branch *c* is passed beneath the receiver and the sucking continued,



when the water will pass from *a* to *b*, and the gas from the receiver fill the cylinder *a*. It may now be transferred to another vessel by introducing the same branch and blowing in air at *d*. J. L. S.

25. *Iridescent Silver.*—(In a note from Prof. JOHN BROCKELSBY of Trinity College, Hartford, Conn., to B. SILLIMAN, Jr.)—It is well known to those who are conversant with optical phenomena, that the brilliant play of prismatic colors exhibited by mother of pearl is due to the structure of the surface; provided the shell is cut and polished in a particular manner. This interesting fact was announced to the scientific world in 1829 by the discoverer, Dr. BREWSTER, who

successfully transferred by pressure the splendid tints of the pearl to black wax, fusible metal, balsam of tolu, lead, tin, and various other substances. The colors displayed by fusible metal possess at first extraordinary beauty, which in a short time is partially lost, owing to a change that occurs upon the surface of the metal.

A few months ago, while engaged upon some experiments in electrotyping, I was led to think that by this process the hues of the pearl might be readily transferred to those metals, which from their hardness are incapable of receiving impressions in mass, but yet, on account of their freedom from oxidation, retain for a long time a surface comparatively pure. I therefore took a Smee's battery, which I had just constructed, and after several experiments succeeded in obtaining small sheets of silver, radiant with the hues of the shell. When seen by a single light, as that of a lamp, the play of colors is surpassingly beautiful, scarcely inferior to that of the pearl; and where equal care was employed, the plate of silver, which was formed eight months ago, rivals in brilliancy that which came fresh from the battery a few hours since.

The process by which this result is obtained is as follows. The first thing required is to prepare the shell. This is effected by grinding, and polishing it upon the back, in such a manner as to cut through the numerous concentric strata that compose its substance. When this is done, by the aid of a microscope the surface will be seen covered with delicate grooves, some thousand in an inch, formed by the sections of the concentric laminæ, and this configuration gives rise to the glowing tints of the shell. The next step is to obtain an exact impression of this surface upon some good conductor of electricity. This we are enabled to do by means of fusible metal, if proper precautions are employed in taking the impression. I pursue exactly the same method as in taking the copy of a medal. After fusing the metal, I pour it upon oiled paper, and when the air bubbles cease to rise through the metal the oxide is skimmed from its surface with a card, and as soon as it presents the appearance of a perfect mirror the shell is forced down upon it by a sudden pressure. When the metal has cooled I remove it from the shell, and having ascertained the accuracy of the impression, immediately plunge it, before any change of the surface can occur, into the silver solution, thereby completing the circuit between the poles of the battery. In a few moments the surface of the metal is frosted with silver, and the configuration of the shell exactly copied. A sheet of silver, of sufficient thickness to be easily removed with a pen-knife, will be deposited in the course of five or six hours under favorable circumstances. The battery I have employed consists of two plates of amalgamated zinc and one of platinized silver, six inches by eight.

The working mixture is sulphuric acid and water, the strength varying with the temperature, and the amount of work to be performed. I have found a wine-glass of acid to three quarts of well-water, at the temperature acquired by standing a few hours in a room at 70° Fah., to answer very well, when the surface to be plated did not exceed $1\frac{1}{2}$ square inches. The silver solution is made by dissolving cyanide of potassium in water, and adding thereto the oxide of silver. The ratio of the ingredients I am unable to state, as I have not hitherto directed my attention to this point, but have prepared the solution by trial until I obtained the desired result.

By the process above described, we can at pleasure transfer the tints of the pearl to those pure metals, which will best preserve their brilliancy, and while the knowledge of this fact is interesting as a matter of science, it may perhaps be well for the artist to consider if it cannot be applied to some ornamental purpose, and the beauty of the precious metals enhanced, by teaching them to glow with the richest hues of light.

26. *On the Volumes of Atoms and their Relation to the Position of the Elements in the Electro-Chemical Series;* by M. Avogadro, (Bib. Univ. Genev. June, 1845, p. 182; from Mem. Acad. Roy. Turin, Vol. viii.)—The author gives the following table, and demonstrates that the order of the elements which it presents, is in general their order in the electro-chemical scale; and such discrepancies as appear, he believes will be removed when the molecular volume is more accurately determined.

NAMES OF SUBSTANCES.	MOLECULES, oxygen = 1*m*.	DENSITY, water = 1*d*.	VOLUME, molecular $\frac{m}{d}$.	VOLUME, molecular, gold = 1.
Chlorine,	0·55	1·40	0·395	0·612
Iodine,	1·98	4·95	0·399	0·618
Bromine,	1·22	3·00	0·407	0·632
Carbon, (diamond,)	1·50	3·50	0·429	0·665
Sulphur,	1·00	2·00	0·500	0·775
Phosphorus,	0·98	1·77	0·553	0·858
Palladium,	6·66	11·70	0·569	0·882
Platinum, Iridium,	12·33	21·50	0·573	0·889
Rhodium,	6·51	11·10	0·586	0·909
Osmium,	12·44	19·50	0·638	0·989
Gold,	12·43	19·26	0·645	1·000
Silver,	6·76	10·47		
Manganese,	6·29	8·01	0·785	1·218
Mercury, (solid,)	12·66	15·50	0·817	1·266
Arsenic,	4·70	5·75	0·817	1·267
Cobalt,	7·38	8·50	0·868	1·346
Nickel,	7·40	8·40	0·881	1·366
Iron,	6·78	7·60	0·892	1·382
Copper,	7·92	8·80	0·901	1·396
Tin,	7·35	7·29	1·008	1·563
Lead,	12·94	11·40	1·135	1·760
Zinc,	8·06	7·00	1·151	1·785
Potassium,	1·22	0·86	1·424	2·209
Sodium,	1·45	0·97	1·500	2·325

M. AVOGADRO has fixed upon 0·650 as expressing neutrality, or a state neither basic or acid, gold being the unit. He next deduces an *affinitary* number by taking the cube roots of the molecular volumes, which he finds to express the actual relations he had elsewhere determined for the elements, as regards the strength of their affinities. Thus $\sqrt[3]{0{\cdot}65}=0{\cdot}866$, will be the affinitary number of the neutrality point in the scale; $\sqrt[3]{2{\cdot}209}=1{\cdot}303$, the affinitary number for potassium; consequently $1{\cdot}303-0{\cdot}866=0{\cdot}437$, is the distance of potassium from the point of neutrality. The following table contains his results; which however he considers as only approximations, that more accurate data will hereafter correct.

Names of substances.	Affinitary number, (gold = 1).	Affinitary number, (ox. = 1).	Names of substances.	Affinitary number, (gold = 1).	Affinitary number, (ox. = 1).
Oxygen,	0·214	1·00	Gold,	1·000	4·67
Chlorine,	0·849	3·97	Silver,		
Iodine,	0·852	3·98	Manganese,	1·068	4·99
Bromine,	0·859	4·01	Mercury,	1·082	5·06
Point of neutrality,	0·866	4·05	Arsenic,		
Carbon,	0·873	4·07	Cobalt,	1·104	5·16
Sulphur,	0·919	4·29	Nickel,	1·109	5·18
Phosphorus,	0·950	4·44	Iron,	1·114	5·21
Palladium,	0·959	4·48	Copper,	1·118	5·22
Platinum,	0·962	4·50	Tin,	1·161	5·43
Iridium,			Lead,	1·207	5·64
Rhodium,	0·969	4·53	Zinc,	1·213	5·67
Osmium,	0·996	4·65	Potassium,	1·303	6·09
			Sodium,	1·325	6·19

27. *Connection between the constitution and boiling point of organic substances;* by M. S. SCHRÖDER, (Ann. de Chim. et de Phys. xiii, 1845, p. 145, from Ann. Pogg. lxii, p. 184.)—M. SCHRÖDER has deduced the following general laws:—

1. The molecular volumes of the equivalents of organic bodies are equal in the liquid state at equal distances from their point of ebullition; the volume of the compound is equal to the sum of the volumes of the constituent elements; these volumes are represented by entire numbers and have a simple relation.

Thus from the elementary composition and the point of ebullition, the density in the state of vapor may be determined; and reciprocally, knowing the elementary composition and the density of the vapor, the equivalent of a substance may be deduced.

2. The equivalents of volatile organic substances, generally adopted, and the equivalents of their elements, are too large compared with those of the metals and ought to be divided by 2.

The atomic weights of most metals are consequently double what they should be compared with those of oxygen, hydrogen, carbon, nitrogen, sulphur, chlorine, bromine, iodine, as GERHARDT endeavored to demonstrate.

3. The density of the vapor of a substance or its equivalent being given, as also the elementary composition and point of ebullition, the nature of its constituent parts may be determined, provided the compound does not include components which have not been isolated, and whose influence upon the point of ebullition has not been ascertained.

4. Reciprocally, from the composition, we may deduce—1, the equivalent; 2, the density of its vapor; 3, the density in the liquid state; 4, its point of ebullition.

These several laws are illustrated by numerous examples, and the influence of different radicals on the boiling point given. Thus water of "hydratation" ($H^4\ O^2$) raises the point of ebullition of a substance 113·5° C. The oxyd of carbon ($C^2\ O^2$), 57°; carbonic acid ($C^2\ O^4$), 90°; formyle ($C^4\ H^4$), 52°; methylene $(C^2\ H^4)^m$, 21°; $(C^2\ H^4)^e$, 17°; and hydrogen (H^4) diminishes the temperature of ebullition 3°.

Benzine ($C^{12}\ H^{12}$) boils at 86°, MITSCHERLICH.

Retinaphtha ($C^{14}\ H^{16}$) boils at 108°, WATER.

Retinaphtha consists of methylene and benzine; the point of ebullition should therefore be 21°; and observation gives 22°.

Ether ($C^8\ H^{20}\ O^2$) boils at 35·7°, GAY LUSSAC.

Carbonic ether boils at 125° to 126°, ETTLING.

The point of ebullition, as above given, ought to be 90° greater for carbonic ether than for ether, and so it is.

Oxalic ether ($C^{12}\ H^{20}\ O^8$) boils at 183° to 184° C., DUMAS and BOULLAY. And as it differs from carbonic ether in the addition of oxyd of carbon ($C^2\ O^2$), the point of ebullition should be raised 57° and observation gives 57° to 58°.

To determine the point of ebullition of Tetramethylene $(C^2\ H^4)^m_4$ *from that of Benzine, that is, from triformyle* $(C^4\ H^4)^3$.—Formyle raises the boiling point 52°; consequently triformyle will raise it $52\times3=156°$; methylene raises it 21°; and tetramethylene consequently $21\times4=84°$.

The boiling point of benzine is 86°; now if benzine, which raises the temperature 156°, has for its boiling point 86°, which is 70° less than 156°, then tetramethylene, which raises the temperature 84°, will have for its boiling point 14°, which is 70 less than 84°. M. BOUCHARDAT has obtained a carburet of hydrogen ($C^8\ H^{16}$) which boils at 14·5°, and he has called it *Caoutchène*. This carburet is no other than tetramethylene.

Alcohol $=(C^4\ H^{12}\ O^2)$, or is a hydrate of bielayle $(C^2\ H^4)^2_2\,(H^4\ O^2)$; it boils at 78·4°. The number representing the influence of its component parts is $2\times17=34°$ for bielayle; and 113·5° for water; the sum equals 147·5°. Subtracting 78·4°, the boiling point of alcohol, we obtain 69·1°. We find now the boiling point of benzine or triformyle by subtracting 69·1° from $3\times52=156°$, which represents the influence of triformyle. We thus obtain 87°; observation gives 86°.

The author goes on to give the calculated and observed boiling points for a great variety of substances, and with those whose composition is fully understood, the results corroborate throughout his most remarkable deductions.

28. *Contraction of Ice in Cooling*, (Ann. de Chim. et de Phys., 3d series, xiv, 1845, p. 369.)—M. BRUNNER, by a series of experiments, has shown that, contrary to the observations of M. PETZHOLDT, ice contracts by cold. He obtained the following as the amount of linear contraction for 1 degree of Centigrade, by three methods—·0000416, ·0000315, ·0000395; from which is deduced the mean ·0000375 or $\frac{1}{26700}$. This is equivalent to ·00002083 for a degree of FAHRENHEIT. The contraction of ice consequent upon a diminution of temperature, is greater than that of any other solid body hitherto examined. The following table gives the density at different Centigrade temperatures.

Temperature.	Density of Ice.	Temperature.	Density of Ice.	Temperature.	Density of Ice.
0° C.	0·91800	— 7° C.	0·91879	—14° C.	0·91957
—1	0·91812	— 8	0·91890	—15	0·91968
—2	0·91823	— 9	0·91901	—16	0·91980
—3	0·91834	—10	0·91912	—17	0·91991
—4	0·91845	—11	0·91924	—18	0·92002
—5	0·91856	—12	0·91935	—19	0·92013
—6	0·91868	—13	0·91946	—20	0·92025

Just the reverse is the case with water, which continues to *dilate* by increase of cold, as shown by M. DESPRETZ, whose experiments were carried to —20° C., (—4° F.)

29. *Transparency of Quicksilver*, (L'Institut, No. 605, p. 279.)—M. MELSENS has found that quicksilver in minute globules is transparent and transmits a blue light, slightly tinged with violet. These globules are formed when a fine stream of water is dropped on a mercury bath; the drops of water, in consequence of falling with some force, become covered with a thin pellicle of mercury, which present the fact here stated. The result has been verified by ARAGO.

30. *On Wax;* by M. B. LEWY, (extracted from M. LEWY's memoir, Ann. de Chim. et de Phys. xiii, 1845, p. 438.)—Beeswax is changed completely into a soluble soap when treated with a very concentrated solution of potash.

Treating wax with boiling alcohol, dissolves out the *cerine*, which on cooling is deposited in fine needles. On evaporating the alcohol after filtration, another compound is obtained, called *ceroleine*. Ceroleine is very soft, melts at 83·5° F., is very soluble in cold alcohol and ether; it constitutes 4 to 5 per cent. of the wax.

From the soap obtained with potash, muriatic acid separates an acid named *cerinic acid;* it is white and crystallizable.

A vegetable wax is obtained in China from a Rhus (*R. succedaneum*,) which requires a temperature of 180° F. for fusion. It is but slightly soluble in boiling alcohol or ether, but completely so in naphtha. With a lye of potash it forms a soluble soap; it also combines with baryta.

The *Palm wax* from New Grenada is obtained from the *Ceroxylon andicola*. The scrapings from the exterior of the tree are boiled by the Indians, and the wax swims on the surface of the water. After being purified, it has a yellowish white color and fuses at 161½° F.; it is but slightly soluble in boiling alcohol.

Other kinds of wax of vegetable origin are, the wax of the *Myrica cerifera;* of *Carnauba*, derived from a palm in northern Brazil; of *Ocuba*, from a tree in the provinces of Para and Guyana, and afforded by a species of *Myristica* (either the *M. ocoba*, *officinalis*, or *sebifera*;) of *Bicuiba*, derived from the *Myristica bicuhyba*, according to Brongniart; of *Sugar-cane;* and of *Andaquies* from the upper regions of the Oronoco and Amazon east of the Cordilleras. Of each of these varieties, analyses are given by M. B. Lewy. He concludes by expressing his doubts with regard to the experiments of Milne Edwards and Dumas upon the animal origin of beeswax, and sustains the view that it is collected by the bees.

31. *Organic Compounds*, (L'Institut, 1845, xiii, p. 333.)—M. Laurent has arrived at the conclusion, after numerous analyses and comparisons, that in all the organic compounds, the sum of the atoms of nitrogen and hydrogen (or of the bodies which may replace hydrogen, such as the halogen bodies and the metals) is always divisible by *four*.

32. *Analysis of a Chinese Metallic Mirror*, (L'Institut, 1845, p. 332, from Erdmann's Jour. 1845, No. 8.)—M. Elsner obtained by his analysis the following results:—

	I.	II.
Copper,	80·823	80·850
Lead,	9·389	10·038
Antimony,	8·431=98·643	8·430=99·318

The mirror was a very perfect one, and was scarcely at all tarnished. It afforded a trace of iron but no arsenic. He suggests as probable, that in preparing the alloy equal parts of lead and antimony were employed, but that a part of the antimony was volatilized during the fusion.

33. *Air of Mines*, (L'Institut, No. 603, 1845, p. 255.)—M. Leblanc, on analyzing the air of Poullavuen mine, finds that when most altered by respiration and combustion of lamps, there is 3 to 4 per cent. of carbonic acid, and a diminution of 4 to 5 per cent. in the proportion of oxygen. The miners' lamps are extinguished; but by placing the meshes of two lamps in contact, combustion often goes on where one

alone fails. The respiration of the miners is a little impeded, but work is possible when this limit is not exceeded, provided the temperature is low. Air collected at Huelgoet, in an unoccupied shaft, showed a diminution of 10 per cent. in the amount of oxygen, without a replacement of the same by carbonic acid, which circumstance he attributes to the influence of decomposing pyrites.

34. *Bezoardic acid.*—This acid according to Wöhler, is identical with the ellagic acid of Braconnot.

35. *Litharge*, (L'Institut, No. 605, p. 276.)—M. F. Leblanc has determined that oxygen will dissolve in litharge in fusion, in the same manner as in silver, without forming a superoxyd ; also that nitrogen probably dissolves in a feeble proportion in the same manner. He concludes also that litharge and red lead differ only physically in structure, color and density, but not in composition.

II. Mineralogy and Geology.

36. *Cancrinite, Nepheline, and Zircon, from Litchfield, Maine ;* by Dr. C. T. Jackson, (from the report in the Proceedings of the Geol. Assoc., for 1845.)—The Cancrinite was found by Mr. Stacy, in boulders in granite, associated with Zircon and Nepheline. The masses are an inch or more in diameter, with some indications of a rhombohedral cleavage. They are translucent, with a deep azure blue color. Hardness=6 ; specific gravity=2·420—2·462. The mineral gelatinizes in acids quickly. Before the blowpipe it loses its color, becoming transparent below a red heat; and at a red heat it melts to a colorless glass.

The Nepheline occurs occasionally in six-sided prisms of a lemon or sulphur yellow color, with a vitreous lustre inclining to resinous ; also in masses with a somewhat oily lustre and a greenish yellow color, (variety Elæolite.) The crystals have the specific gravity 2·42, and the Elæolite variety, 2.442. The hardness is 5 to 5·5.

The following are the analyses of these minerals, by Dr. Jackson :

	Cancrinite.		Nepheline.
Silica, . . .	35·400	. . .	34·700
Alumina, . .	31·750	. . .	28·000
Soda, . . .	17.578	. . .	13·360
Sulphuric acid, .	6.460		
Oxyd of Manganese,	4·397	Oxyd of manganese and of tungsten ?	3·700
Magnesia, . .	1·800	. . .	2·800
Lime, . . .	1·856	. . .	8·440
Water, . . .	0·875		

In the analysis of the Cancrinite, if the sulphuric acid be regarded as sulphur, it will amount only to 2·592 per cent., and indicates a loss of 3·752 per cent. Dr. Jackson states that it is probable that a portion of the sulphur must be in a state of sulphuric acid, while another por-

tion combined with sodium and alumina probably gives the rich blue color to the mineral. The analysis differs essentially from that in Poggendorf's Annalen, xlvii, p. 179, in the occurrence of sulphur and sulphuric acid in place of carbonic acid. Dr. JACKSON consequently analyzed a specimen of the foreign mineral so far as to ascertain that no carbonic acid exists in it, and that it does contain sulphur and sulphuric acid.

The crystals of *Zircon* are short prisms, sometimes highly modified. One crystal found by Mr. STACY, was a little more than one inch in diameter.

37. *Iberite, a new mineral from Montalvan, province of Toledo, Spain;* by E. C. NORLIN, (Bib. Univ. Geneva, July, 1845, p. 375; from Compt. Rend. Acad. Stockholm.)—This mineral occurs in large hexagonal prisms and is near Gigantolite. It has both lateral and a basal cleavage; hardness 2·5; specific gravity 2·89; fracture scaly; color pale grayish-green; opaque, with a lustre between pearly and vitreous. Exposed to the blowpipe it melts at a strong heat and fuses perfectly into a glass; and in a tube it gives off water. Composition, according to M. NORLIN, silica 40·901, alumina 30·741, protoxyd of iron 15·467, potash 4·571, soda 0·043, protoxyd of manganese 1·327, lime 0·397, magnesia 0·806, water 5·567=99·820; from this he deduces the formula

$$(\dot{Fe}, \dot{K})^3\ \ddot{Si} + \ddot{Al}^2\ \ddot{Si} + 3\dot{H}.$$

Amphodelite has the same formula, exclusive of the water.

38. *Damourite, a new mineral*, by M. DELESSE, (L'Institut, No. 605.)—Damourite is a hydrosilicate of alumina, having the formula, according to DELESSE, $\ddot{Si}\ \dot{K} + 3\ddot{Si}\ \ddot{Al} + 2\dot{H}$. It occurs in small lamellar crystals, having a pearly lustre, and a little harder than talc. Its specific gravity is between 2·74 and 2·82. Before the blowpipe it melts with difficulty to a white enamel, not acted upon by muriatic acid or aqua regia; it is completely attacked by sulphuric acid.

39. *Diaspore*, (L'Institut, No. 605.)—DAMOUR finds that this mineral is attacked by acids after being strongly calcined, and has thus analyzed it. His results were the same with those of BERZELIUS and DUFRENOY.

40. *Native Lead.*—Native lead has been detected in the carboniferous limestone near Kenmar, County of Kerry, Ireland. It occurs in grains in crevices in the rock, and fragments weighing half an ounce are said to have been obtained. This mineral is said also to occur in the chain of Luquillo, at Porto Rico.

41. *Crystallization of Sulphuret of Cadmium and Perowskite;* by M. DESCLOISEAUX, (Ann. de Chim. et de Phys., xiii, 1845.)—The form is a hexagonal prism terminating in the faces of one or more six-sided pyramids, and with a truncate summit. DESCLOISEAUX has determined

the relation between the vertical and a lateral axis to be as 689 : 418. The inclination of P or the terminal plane, on the four faces in succession, observed between P and M, (a lateral plane of the prism,) are as follows :—P : b^2 = 154° 33′, (154° 32′ observed by Breithaupt ;) P : b^1, 136° 25′ (136° 23′, by Breithaupt ;) P : $b^{\frac{1}{2}}$ = 117° 43′ ; P : $b^{\frac{1}{4}}$ = 122° 9½′.

Perowskite is a titanate of lime, from the Ural, and occurs in modified cubes. Descloiseaux figures a very complex crystal with 7 planes on each edge, and 10 on each angle, or 164 faces in all. The modifications are in part hemihedral.

42. *Baryto-calcite ;* MM. Descloiseaux and Dumas, (Ann. de Chim. et de Phys., xiii, 1845, p. 425.)—This mineral assumes two distinct forms, one an oblique rhombic prism and the other a right rhombic ; the former is from Alston Moor, and the latter from Fallowfield. Analyses by Descloiseaux and Dumas confirm the view that they are identical in composition ; the formula is $\ddot{C}\,\dot{B}a + \ddot{C}\,\dot{C}a$.

43. *Fluids and Crystals in Topaz*, by Sir David Brewster.—These crystals and fluids, occupying cavities in topaz crystals, have been found to be of various kinds. The crystals present the following different forms. Cube, cube with truncated edges and angles, rhombohedron, prism with plain and pyramidal summits, rhomboidal plates, hexagonal plates, and long rectangular plates ; and Sir David has determined that there are two distinct substances under a tesseral form, and three others among the remaining forms. They are operated upon very differently by heat, some dissolving easily and others not at all.

The fluids are of two kinds, one dense and the other light and volatile. By heat they sometimes made their way out of a cavity between the laminæ to some other resting place or to the surface, the laminæ closing together after the passage of the fluid.

44. *Phacolite observed in New York*, (communicated by Mr. Alger.)—Mr. Alger has detected this mineral among specimens of minerals received from Messrs. Matthews and Johnson, of New York city. It was labelled stilbite, but proves on examination to be *phacolite*. It occurs in geodes, the crystals implanted on calc spar, and associated with silvery mica, and a few scales of specular iron. They are of a wax or honey-yellow color and a waxy lustre, translucent and brittle. It is extremely scarce.

45. *Yttro-cerite*, (ib.)—This rare mineral has been found by Mr. Alger associated with Brucite, in masses of rolled limestone from the town of Amity, Orange County, N. Y.

46. *Dysluite identical with Automolite*, (ib.)—Mr. Alger states that from recent observations of the New Jersey specimens, he is satisfied there is no reason for any longer considering the two minerals distinct.

The characteristic differences heretofore insisted on in color, hardness, specific gravity, &c. being well accounted for by the isomorphous replacement of alumina and peroxide of iron, and protoxide of iron and zinc. This opinion is confirmed by the following comparison of compositions, according to the analysis of automolite by ECKEBERG and ABICH.

Dysluite.		Ox. Ratio.		Automolite.	Ox. Ratio.
Alumina,	30·49	14·23 } 20·51=3	Alumina,	57·09	25·37=3
Perox. Iron,	30·00	6·00 }	Oxide Zinc,	34·80 }	
Protox. Iron,	11·93	2·65 }	Magnesia,	2·22 }	7·42=1
Protox. Mang.	7·60	1·68 } 7·53=1	Protox. Iron,	4·55 }	
Oxide Zinc,	16·80	3·20 } THOMSON.		ABICH and ECKEBERG.	

To confirm this probable view, a new analysis of dysluite is required, to show the iron to be protoxide, as Dr. THOMSON, (the only chemist who has analyzed this mineral,) states it to be peroxide.

47. *Acadiolite of Nova Scotia*, (*Chabasite.*)—Mr. A. A. HAYES, of Roxbury Laboratory, analyzed this mineral for Mr. ALGER's edition of PHILLIPS' Mineralogy. As the analysis has not before been published in this Journal, we annex it.

	I.	II.
Silica, -	52·02	52·20
Alumina, -	17·88	18·27
Lime, -	4·24	6·58
Potash, -	3·03 }	2·12
Soda, -	4·07 }	
Water, -	18·30=99.54 HAYES.	20·52=99·69 HAYES.

These results agree closely with those obtained by HOFFMANN, and prove the identity of this mineral with chabasite, although RAMMELSBERG has given a somewhat different formula for the two.

48. *Washingtonite of Shepard.*—This mineral was analyzed by Mr. J. L. KENDALL, under the direction of Dr. C. T. JACKSON, (also for Mr. ALGER's book,) and gave the following result:

		Ratio of Ox.
Titanic acid, - - -	25·28	1
Peroxide of iron, - - -	51·84	2
Protoxide of iron, - - -	22.86=99·98	1

The identity of this mineral with an Ilmenite from Arendal, analyzed by MOSANDER, cannot be questioned, thus:

		Ratio of Ox.
Ilmenite of Arendal by MOSANDER,—Titanic acid,	24·19	1
Perox. iron,	53·01	2
Protox. iron,	19·91 }	1
Mag. and lime,	1·01 }	

49. *Mexican Fossils*, (cited from Ann. Mag. Nat. Hist. xvi, 1845, p. 212.)—In a letter to Prof. BRONN, M. CLAUSSEN states that he has again

found in Brazil a great many fossil bones, and among them the head of a large tiger related to *Felis meganthereon* (*Ursus cultridens*), but it is much larger; the upper canine teeth are nearly 10 inches long and 1½ broad. The French Institute has purchased it for 4000 francs. The remainder of the collection, except the duplicates, has been disposed of to the British Museum. He promises subsequently to communicate some remarks on the occurrence of these fossil bones, and especially on that of the human remains, which are found among the bones of various extinct animals. He has discovered two kinds of *monkeys*, which approximate to the genera *Mycetes* and *Cebus*. A short time since also, among a number of pieces of amber (not copal), he found some containing insects, in which distinct spiders' webs could be seen (thus fossil spiders' webs!!); in some, the webs and also the insects hanging in them were evident.

50. *The Oust-Urt, and shores of Lake Aral;* (L'Institut, 605, p. 256.) —This region hitherto little known, has been geologically examined by M. S. de Helmersen. He has ascertained, that at the period when the beds of the Oust-Urt were deposited, the Caspian and Aral seas formed a single Mediterranean sea; that at the middle of this sea stood a high island—the Oust-Urt—at whose foot commence formations of marl and sandy clays, in which marine and fresh-water fossils are mingled; that the two seas communicated with one another for a period by a channel, and had a common fauna even to the formation of the most recent deposits, which include some existing species.

51. *Infusoria.*—Ehrenberg has arrived at some remarkable results with regard to the prevalence of infusoria in volcanic rocks. They are as follows:—

Numerous and widely extended observations have proved that there is an ultimate reciprocal relation between independent infusorial life and the volcanic phenomena exhibited upon the banks of the Rhine. Volcanic crystals of sodalite, leucite, and probably of augite, consist in part of masses of infusoria.

The volcanic island of Ascension, so destitute of life, animal and vegetable, and even of streams of water, and situated in mid-ocean, presents an enormous mass of volcanic cinders which consist almost wholly of organic matters, principally of fibres of plants, along with some *fresh-water* siliceous infusoria.

Although observation shows that in all parts of the world the infusoria, prevalent in volcanic rocks, are of *fresh-water* origin, still Patagonia affords *marine* deposits, constituting masses of great thickness.

The Pyrobiolitic rocks in Patagonia constitute extensive beds 800 feet thick, containing no carbonate of lime, and only here and there a little sulphate of lime.

The cinders which have been ejected by Pompeii, are of fresh-water formation; and they are similar to those constituting the tufa of Hochsimmer, on the Rhine.

The bed containing the fossil Mastodon, on the La Plata, and that of the fossil bones at Monte Hermosa, and the hills in the plains of Bahia Blanca, are formations of fresh-water origin, mixed with some marine.

52. *Abundant occurrence of rare Infusoria in the Scallop.*—(To the Editors of the Annals of Natural History.)—GENTLEMEN: The discovery some time since of the siliceous shells and cases of animalcules in the stomach of recent *Lepades*, belonging to many of the genera and some of the species which constitute a large proportion of the miocene tertiary strata of Virginia, was announced in Dr. MANTELL's recent work, the 'Medals of Creation.' (See vol. i, p. 586.) This fact, so highly interesting in a geological point of view, has been fully established by many; and among others by the Rev. J. B. READE, who has communicated the result of his examination of the oyster to the Microscopic Society. Having subsequently extended my investigations to the contents of the digestive sac of other mollusks, it may interest your readers to be informed that the common scallop (*Pecten maximus*) now in season, and therefore easily obtained, contains a richer assemblage of the most beautiful siliceous carapaces of animalcules than any other of the mollusca hitherto noticed.

So abundant and diversified are these forms in the scallop, that a few grains of the undigested contents of the stomach, properly prepared and mounted on a glass slide, exhibits many of the species usually found in the Richmond earth, and indeed could not be readily distinguished from a similar preparation of the fossil forms.

Another remarkable fact, also noticed in the 'Medals,' (see p. 233,) that of the occurrence of the mineralized bodies of Polythalamia, is fully confirmed; and when the eye of the observer becomes accustomed to the appearances presented by remains of this kind, they will be found abundantly in most chalk flints. I discovered one species in an atom of flint, in which the entire body of a *Rotalia*, except that part of it which occupied the outer cell, is as beautifully preserved as that of an insect in amber.

I am, gentlemen, yours obediently, HAMLIN LEE.

Chester Square, Pimlico, April 21, 1845.

53. *On the Microscopic Constituents of the Ash of Fossil Coal;* by Professor EHRENBERG, (Ann. Mag. Nat. Hist., xvi, 1845, pp. 69, 70.)—At the meeting of the Berlin Academy of the 25th of October, Prof. EHRENBERG communicated an observation of Dr. FRANZ SHULZ of Eldena, which the latter had addressed to M. v. HUMBOLDT in a letter, in which he describes his method of separating the silica contained in coal so chemically pure as to enable us to recognize the microscopical

siliceous organisms. "The usual method of burning the coal," Dr. Schulz states, "is attended with an unavoidable vitrification of the mineral constituents, even when conducted in the slowest and most cautious manner, owing to which their cellular structure is lost. After many fruitless experiments I succeeded in hitting upon a method of incineration, which leaves the silica contained in the coal perfectly unaltered. Very instructive preparations are readily obtained (from the already known structural relations of siliceous earth in plants) on moistening grass-halms, ears of grain, *Equisetum*, Spanish cane, &c. with nitric acid, and afterwards burning them on platinum foil. The nitric acid not only facilitates the combustion of the organic substance, but also prevents the potash combined with the vegetable acid from being converted into carbonate of potash before the silica has been heated to such a degree as to be less liable to be acted upon. The greater degree of heat required for the perfect combustion of the coal no longer destroys the cellular form of the silica after nitric acid has prevented the production of carbonate of potash on the first application of heat. An excess of nitric acid has the effect of destroying the connexion of the siliceous cells and acts too powerfully upon them, and should therefore be avoided.

"Encouraged by the success of these experiments, I turned my attention to coal, it being exceedingly desirable to be enabled to detect remains of organic structure in it. The large quantity of siliceous earth contained in all varieties of coal led me to infer that a judicious method of incineration would be attended with good results; your excellency will be enabled to judge from the preparation attached in how far I have succeeded. A piece of coal of about two square inches was broken into twelve pieces of nearly the same size, and then treated with nitric acid in a platinum vessel. The nitric acid being evaporated at a moderate heat, I ignited the residue until no further empyreumatic vapors were given off, treated the residue again with nitric acid and repeated the ignition. Thus prepared, the coal was placed in a platinum crucible with a lid perforated in the centre, and air was blown from a gasometer through the aperture in the lid, whilst the crucible was kept at a red heat over a spirit-lamp, so that the coal was necessarily slowly consumed. The ash thus obtained had not coked, but formed a brownish powder. Some white splinters occur among this, which appear on microscopical examination to be aggregated siliceous cells arranged in regular succession, of the structure of the prosenchymatous cells of wood."

Prof. Ehrenberg added, that the importance of a method for obtaining the organized siliceous parts from the lower strata of the earth with their forms preserved for microscopical observation is manifest, and

requires no recommendation, to judge from the results which have already ensued. His own efforts with respect to coal had never been attended with success, and he therefore considers this method as a most useful and important discovery. He further stated that the clearness of the specimens (which were, it was to be regretted, not numerous) communicated by M. Schulz had astonished him, and, as might have been expected, had immediately been attended with a result. Prof. Ehrenberg had during many years brought before the Academy descriptions of the parts of plants (containing silica) which are found in marshy soils of all zones and in the infusorial deposits, and had likewise alluded to their origin from recent plants. This group, called *Phytolitharia*, had been as it were classified by him into eleven genera. Of these eleven genera only one is found in several forms in the purified siliceous ash of the coal forwarded by M. Schulz, namely the genus *Lithostylidium*, which contains regular siliceous nuclei of cells of plants. *Lithodontia*, or marginal teeth of grasses, *Lithodermatia*, or epidermis of plants (*Equisetacea Arundinacea*), could not be distinctly recognized, although the presence of the latter may be presumed. Other negative results were also particularly remarkable, namely the absence of all *Lithasterisci*, *Lithosphæræ*, *Spongolites*, &c. &c., otherwise so frequent. Finally, no trace of infusoria possessing a siliceous shell was found, notwithstanding the most careful investigation.

He concluded by expressing a conviction that a rapid development of our knowledge on this subject would, now that a method had been discovered, undoubtedly take place, and a wish that this may be the commencement of its study.

54. *On some New Species of American Desmidiaceæ, from the Catskill Mountains;* by J. W. Bailey.—During the month of August, 1845, I collected from the ponds near the Catskill Mountain House, a portion of the sediment adhering to various submerged bodies, and on submitting it to microscopic examination, I found it unusually rich in interesting organisms. Among these were some which appeared to me to be so novel and interesting, as to merit being placed on record by at least the following brief notice.

1. *Euastrum muricatum*, (figs. 1 and 2.) Body binary, each half divided by deep indentations into three transverse portions, of which the one nearest the middle has six projecting arms, (three on a side,) and the other two have each four arms, (two on a side.)

Fig. 1.

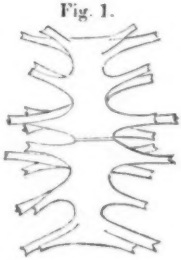


Fig. 2.

This is one of the most remarkable species of *Euastrum* which I have yet

seen, and is at once distinguished from all known species by its numerous arms or projections, of which those belonging to each principal subdivision are not arranged as usual in the general plane of the body, but one above another in the plane perpendicular to the broadest surface to the individual. These arms much resemble those of *Xanthidium Arctiscon*, Ehr., and terminate in a similar manner in three or four diverging points. Its size is equal to the largest of the genus. It is rather rare in the Catskill Ponds.

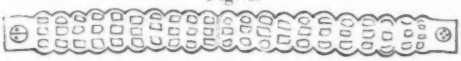
Fig. 1 gives the front view, and fig. 2 an oblique view of the body thrown up on edge.

2. *Closterium nodosum*, (fig. 3.) Body binary, straight, somewhat cylindrical, each half having four prominent nodes.

Fig. 3.

This species is easily recognized by the deep indentations in its outline, corresponding to the constrictions which separate the transverse rows of knot-like projections. The clusters of moving corpuscles are near the extremities. When highly magnified, the outline shows something resembling minute pubescence. It is one of the largest species of the genus. I found vast numbers of this species in the Catskill Ponds, all agreeing with the above description.

Fig. 4.



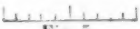


Fig. 5.

3. *Closterium verrucosum*, (fig. 4.) Body binary, straight, cylindrical, with numerous transverse rows of small prominences. Moving corpuscles near the extremities. This is a pretty species, with a waved outline caused by the slight projections, which are arranged in numerous transverse rings. It is quite abundant with the preceding in the Catskill Ponds.

The detection of the above forms gives reason to hope, that other species equally curious may be found when the productions of other sub-alpine ponds are examined.

N. B. The figures which accompany this notice are drawn to the scale which is represented by fig. 5. This shows $\frac{1}{100}$ of a millimetre magnified equally with the drawings, which are much less amplified than those given in the plates of the American *Bacillaria*.

III. Zoology.

55. *The Blood-Corpuscle considered in its different phases of development in the Animal Series;* by Thos. Wharton Jones, Esq., F. R. S., lecturer on Anatomy, Physiology and Pathology, at the Charing Cross Hospital, (Roy. Soc. June, 1845.—Ann. Mag. Nat. Hist. xvi, 1845, 131.) —This paper is divided into three parts; the first relating to the blood-corpuscles of the Vertebrata; the second to those of the Invertebrata; and the last to a comparison between the two. He first describes the microscopic appearances of these corpuscles in different classes of vertebrate animals, beginning with the skate and the frog, and proceeding to birds and mammifera; first in their early embryonic state, and next in the subsequent periods of their growth. He finds in oviparous vertebrata generally, four principal forms of corpuscles. These he distinguishes as the phases, first of the *granule blood-cell*, which he describes as a cell filled with granules, disclosing by the solvent action of dilute acetic acid on these granules a vesicular, or as the author terms it, a "*cellæform*" nucleus. These granule cells appear under two stages of development, namely, the coarsely granulous stage and the finely granulous stage. The second phase is that of the *nucleolated blood-cell*, oval in shape, containing a vesicular (or "cellæform") nucleus, and red-colored matter. These cells likewise appear under two stages of development; colorless in the first and colored in the second, in which last stage it constitutes the *red corpuscle*. In the early mammiferous embryo, he finds, in addition to the former, a third phase, that of *free vesicular nucleus*, exhibiting, like the nucleolated cell, the colorless and the colored stages.

On examining the corpuscles of the lymph of vertebrate animals, the author finds them in all the classes to be identical in structure with their blood-corpuscles, and differing only in the inferior degree of coloration, attending their last stage. In the oviparous classes, he observes that the nucleolated are more numerous than the granule cells, while in the mammifera the latter are predominant, which is the reverse of the proportion in which they exist in the blood of these animals. He finds that some of the nucleolated cells of the contents of the thoracic duct exhibit a marked degree of coloration, and have an oval shape; thus offering a resemblance with the blood of the early embryonic state.

The blood-corpuscles of all the invertebrate animals in which the author examined them, present the same phases of granule and nucleolated cells as in the higher classes, excepting that in the last stage of the latter phase the coloration is very slight, but the vesicular nucleus is frequently distinctly colored. As in the higher classes, corpuscles exist in different states of transition from the granular to the nucleola-

ted form of cell. In some of the invertebrata, corpuscles are found which appear to be the nuclei of some of the nucleolated cells become free ; and these the author considers to be abortions, rather than examples, of cells having attained their third phase of free cells. Corpuscles are also met with in these animals, in greater or less abundance, belonging to the lowest forms of organic elements, namely, elementary granules.

The comparison which the author institutes between the blood-corpuscles of the vertebrate and invertebrate divisions of the animal kingdom, tends to show that they in all cases pass through similar phases of development, except with respect to the last, or colored stage of the nucleolated cell, which they do not attain in the lower classes of animals. He finds that the blood-corpuscles of the crab, according to an analysis made by Professor GRAHAM, contain a sensible quantity of iron, perhaps as much as red corpuscles. He considers the corpuscles of the blood of the invertebrata, in as far as relates to the absence of nucleolated cells, as resembling those of the lymph of vertebrate animals.

56. *On the Extinct Mammals of Australia, with Additional Observations on the genus Dinornis of New Zealand ;* by Professor OWEN, (Mag. Nat. Hist. xvi, 1845, p. 142.)—In a previous report Professor OWEN had demonstrated the former existence in Australia of two genera of Marsupial animals, rivalling in size the rhinoceros and hippopotamus of the old continent. Since the reading of his first report, Prof. OWEN had received three molar teeth belonging to the upper jaw of the *Diprotodon ;* the crown of each tooth was divided into two principal transverse ridges, like those of the lower jaw, and the enamel presented the wrinkled and punctate surface peculiar to the genus. With these was found a large scalpriform incisor, whose bevelled cutting edge showed that it worked upon a similar tooth in the lower jaw. The *Diprotodon*, therefore, had molars like the kangaroo ; but, instead of the two large incisors in the lower jaw being opposed to six smaller in the upper, as in the kangaroo, it had two large incisors above as well as below, agreeing in form and structure, and relative size, with those of the Wombat. Prof. OWEN considered himself justified in concluding that the *Diprotodon* combined the characters of *Phascolomys* with those of *Macropus*, exhibiting both upon a gigantic scale, and constituting one of those links in the chain of being which the course of time has broken and destroyed. Prof. OWEN also stated that a large collection of bones of the Dinornis had been obtained from a new locality by Mr. PERCY EARLE. This collection contains four of the species of Dinornis already described, including the three most remarkable for gigantic stature. One of these, with a stature nearly equalling the ostrich, presents in all the bones of its leg double the thickness in pro-

portion to their length, and must have been the strongest and most robust bird in proportion to its size that ever existed. Of the gigantic species, vertebræ, ribs, and an almost entire sternum, most resembling that of the Apteryx, have been obtained. The Rev. Mr. WILLIAMS has also transmitted the cranial portion of a skull related in size to the *Dinornis struthoïdes*, manifesting many peculiarities and a striking resemblance to the same part in the Dodo and Apteryx.

57. *On the Boring Apparatus of the Carnivorous Gasteropods, and of the Stone and Wood-burrowing Bivalves;* by ALBANY HANCOCK, Esq., (Mag. Nat. Hist., xv, 1845, p. 113.)—During the investigation of the anatomy of the *Eolidæ* by Dr. EMBLETON and myself, we ascertained, as appears in the last Number of the 'Annals,' that the teeth of these animals are composed of silex. Directed by this interesting fact, I was induced to examine the nature of the instrument by which the carnivorous Gasteropods pierce the testaceous covering of bivalve and other shells. I found this apparatus in *Buccinum undatum* to be composed of rows of stout, much-curved spines or teeth, of great brilliancy, and as glossy and transparent as glass, and certainly to have no appearance whatever of horny tissue. They are so similar to those of *Eolis*, that there could be little doubt that they are formed of the same material; and accordingly, after subjecting them to the action of acid, such was found to be the case. Their capacity to drill holes in calcareous matter is therefore easily understood, without the necessity of supposing the aid of a solvent requisite, as surmised by CUVIER.

This result was to be expected after the discovery of the siliceous nature of the teeth of *Eolis;* but that the wood and stone-burrowing bivalves should work out their excavations by an instrument provided with the same material, may, perhaps appear somewhat startling. Such however I believe is the fact; a fact which if established will at once explain all the phenomena attending this much-controverted problem. It is not my intention at present to enter into details; all that I now wish to communicate is the result at which I have arrived; and in a short time I hope to have the pleasure of publishing, at length, my observations in connexion with this interesting subject.

The excavating instrument of *Pholas* and *Teredo* is formed of the anterior portion of the animal, in the surface of which are imbedded siliceous particles. The particles penetrating the skin give to it much the character of rasping-paper. The whole forms a rubbing surface, which being applied closely to the bottom of the cavity by the adhesion of the foot, enables the animal to rub down, and so penetrate shale, chalk, wood, or even the hardest limestones and marble.

Saxicava rugosa is also furnished with a rasping surface covered with siliceous particles. This surface, however, in this species is formed entirely of the anterior portion of the mantle, the margins of which being united are much thickened, forming a sort of cushion capable of considerable protrusion at the will of the animal. The foot is small, and passing through a much-constricted orifice, gives origin to a byssus, which anchors the shell close to the base of the excavation, and thus holds the rubbing apparatus in immediate contact with the part to be excavated.

58. *The Animal of the Spirula;* by J. E. GRAY, (Mag. Nat. Hist., xv, 1845, p. 257.)—Mr. GRAY states that the animal of the Spirula has hitherto been known only from a figure in the atlas of PERON and LESUEUR. He concludes from his examinations of a specimen in alcohol, (of which he gives figures,) that they resemble closely the cuttle-fish in external form, and will constitute a group of the Decapodous Cephalopods, forming a passage to the Octapodous; for like the latter, they are without a dorsal fin, and have a regularly chambered shell. The shell is enclosed with but a small part exposed, and is placed on the dorsal surface of the body with the spine bent towards the ventral sides.

"The examination of this animal confirms me in the opinion, which I expressed in the Synopsis of the British Museum, (1840, p. 149,) that the Ammonites, from their texture and the small size of the last chamber, are internal shells, and should be arranged with the Decapodous Cephalopods, being chiefly distinguished from the Spirulæ by the siphon, always on the dorsal margin of the whorls, and the septa being foliated on the edges."

59. *Adaptation of the Eye to Distinct Vision at Different Distances;* by Prof. FORBES, (Trans. Roy. Soc. Ed., xvi, 1.)—The crystalline lens,—for example, that of the ox,—is composed of a nearly spherical nucleus of compact, comparatively dense matter, of a hard pasty consistence; this nucleus gradually, yet rapidly passes into the gelatinous envelope, of a lenticular form, which has far less consistence and less resistance to external pressure, than the central spherule. Prof. FORBES thence suggests that any uniform pressure applied to the lens, such as might be communicated by the external muscles of the eye to the entire eye-ball, and propagated by hydrostatic pressure through the humors, would tend to make the exceedingly flattened ellipsoid of the eye approach in figure to the dense spheroidal nucleus; the obvious effect of this would be, to increase the curvature of the lens without changing its position, and thus render the rays from a near object more convergent. The effect probably proceeds from a simultaneous effort of the four *recti* muscles drawing the eye back in its socket.

IV. Botany.

60. *Number of Known Plants as given by Different Authors since Theophrastus, together with the supposed Total;* by R. B. Hind, (in Geographic Botany, Ann. Mag. Nat. Hist., xv, Jan. 1845, p. 12.)

	Known.	Supposed Total.
A. C. 300, Theophrastus, History of Plants, .	500	
A. D. 70, Pliny, History of the World, . .	1,000	
1580, Dodonæus, Stirpium Historia, . .	1,330	
1623, Banhin, Pinax, ...	6,000	
1690, Ray, ...		18,000
Tournefort, ...	6,000	
1753, Linnæus, Species Plantarum, 1st ed.,	7,300	
1762, 2d ed.,	8,800	
1796, Gmelin, Systema Vegetabilium, .	16,635	
1806, Persoon, Enchiridium, . . .	27,000	
Humboldt, ...		44,000
1814, Brown, Flinders' Voyage, . .	37,000	
1820, De Candolle, Théorie Elémentaire, .	50,000	100,000
1824, Prodromus, . .	50,000	
1827, Sprengel, ...	37,000	
1830, Balbi, Geographie, ...		80,000
1835, Lindley, Introduction to Botany, .		86,000
1845, R. B. Hind, (supposing, for reasons which he states, that one third yet remains to be discovered,		134,000

Mr. Hind gives the following as their probable distribution:

		Square Miles.
Europe, ...	11,200	2,793,000
Asia, ...	36,000	12,118,000
Africa, ...	25,200	8,500,000
North America, ...	14,400	11,146,000
South America, ...	40,000	
Australasia, ...	7,200	3,100,000
	134,000	37,657,000

61. *Potato disease*, (L'Institut, xiii, ann. 1845, pp. 325, 328, 343.) —The origin of this disease is traced by M. Payen, as has been done by others, to a cryptogamic vegetation propagating within the tubes. The fungus, whose spirules have followed the liquids infiltrated about the cortical parts especially, and sometimes the axis, develops in the cellules minute anastomosing filaments, which are nourished by the oily ingredients and enclosed fecula. Passing from one cellule to another, they bind the whole together so that the texture is not destroyed at the boiling point. The fibres growing outward towards the exterior sur-

face, attack all the azotized, oily and amylaceous substances which they can assimilate; the fecula or starch is gradually disaggregated, dissolved and absorbed, presenting a novel series of changes in the history of this substance. A humid state of the weather is believed to hasten the development of the potato fungus.

M. POUCHET points out four stages in the process of changes. In the *first* period, the tissues of the potato are hardly discolored; small clear brownish granules are distinguished at the surface of the membrane constituting the cellular tissue, especially in the intercellular spaces; the fecula of the cellules is untouched. In the *second*, the tissues are brownish; the brown granules upon the surface of the cellules have multiplied, and become deeper colored; the fecula is still in a healthy state. In the *third*, the granules have become of a deeper brown color, and the cellules gradually become broken into shreds, the starch or fecula being not yet at all altered. In the *fourth*, the tissues are soft and grayish; the cellular membranes are reduced to brown granulations resulting from the walls of the cellules and the granules on their surface. The starch grains remain "*dans leur integrité.*" M. POUCHET does not believe that this disease results from the growth of a fungus (*Botrytis infestans*,) which M. MOREN has detected upon the leaves of the potato, and regards as its origin. The affection is considered analogous to that which destroys cellulous fruits, such as apples, pears, &c.; and a direct microscopic comparison is stated to favor the view.

The prevailing opinion and most observations are opposed to the views of M. POUCHET. M. PAYEN has compared by analyses the healthy and diseased potato, and found that the fecula has actually been diminished 20 per cent.

V. GENERAL PHYSICS.

62. *Temperature of the Mediterranean;* (extracted from a Memoir on the Temp. of the Medit., by M. AIME, Ann. de Chim. et de Phys., 3d ser., XV, 1845, p. 6.)—M. AIME arrives at the following conclusions from numerous observations on the temperature of the Mediterranean.

1. Near the coast the temperature during the day is higher than in the open sea, and at night lower.

2. The mean surface temperature for the year is nearly that of the air; in spring and summer it is less than that of the air, and in autumn and winter, greater. The surface temperature is never below 50° Fah.; and sometimes reaches to 79°.

3. The diurnal variation ceases to be appreciable at 20 yards, and the annual variation at 350 to 430 yards.

4. On a morning after a clear and calm night, the temperature of the surface is colder than that of the water several yards below.

5. The minimum temperature of the depths of the Mediterranean is equal to the mean temperature of the winter.

In the southern part the temperature decreases through the year, to a depth of 35 to 440 yards. In the northern part it increases during the winter to that depth. It seems consequently that the cold temperature below depends on the descent of the upper cold strata during winter, and not on the entrance of the waters of the ocean.

63. *Boiling point of Water at different heights;* by M. V. REGNAULT, (extracted from Ann. de Chim. et de Phys., XIV, 1845, 196.)—The following table has been made out by M. V. REGNAULT to aid in determining heights by the boiling point of water, a method recommended alike by its simplicity and the portable character of the instrument, and now very commonly adopted in preference to the barometer. The calculated results are shown to vary less than half a line in the height of the barometric column from those by observations.

M. REGNAULT states that the thermometer should be made of the best crystal glass, as others dilate irregularly. They are graduated from 75° to 100° C., (equivalent to 167° to 212° Fah.,) and the following is the method adopted for this purpose. As much mercury is introduced in the usual way as will stand one third up the stem when placed in melting ice; this point (designated n) is accurately marked. The tube is then placed alongside of another graduated thermometer in a large vessel full of water, kept agitated, and exactly at 20° C. (68° Fah.); and the height of the mercury (n') corresponding to the degree of temperature (t) indicated on the graduated scale is noted. $\frac{n'-n}{t}$ will then give the value of a degree. A portion of the mercury is next expelled, so that it will reach towards the top of the tube when in boiling water, and the tube is closed as usual. It is then placed in the vapor of boiling water under a pressure of about 760 millimetres, and the point at which the mercury stands (n'') is noted, and also the exact temperature (T). The value of a corrected degree may then be obtained by the following formula:—

$$\frac{\frac{n'-n}{t}+\frac{1}{6480}(n''-n)}{1+\frac{T}{6480}}$$

The instrument is made of brass tubes that slide into one another like a spy-glass, and is but six inches long when closed up, but may be drawn out to a length of fifteen inches. The lower part, which contains the water to be heated, is one and one-eighth inches in diameter. This is inserted in a large cylindrical vessel, which has a lamp at bottom. The thermometer is dropped down into the vapor just above the surface of the boiling water.

The table gives for each tenth of a degree Centigrade, between 85° and 101°, the amount of barometric pressure reduced to 0°, corresponding to the temperatures observed, of boiling water. The calculations are in French measures. A millimetre = .03937 English inches. The Centigrade scale is used in the table.

Table of the tension of the vapor of water in millimetres, from 85 *to* 101 *degrees* C.

Degree.	Tension.	Diff.	Degree.	Tension.	Diff.	Degree.	Tension.	Diff.	Degree.	Tension.	Diff.
°	*mm*		°	*mm*		°	*mm*		°	*mm*	
85·0	433·04	1·71	89·0	505·76	1·94	93·0	588.41	2·20	97·0	682·03	2·49
85·1	434·75	1·71	89·1	507·70	1·95	93·1	590·61	2·21	97·1	684 52	2·50
85·2	436·46	1·71	89 2	509·65	1·95	93 2	592·82	2·22	97·2	687·02	2 51
85·3	438·17	1·72	89·3	511·60	1·96	93·3	595·04	2·22	97·3	689·53	2·51
85·4	439·89	1·73	89·4	513·56	1·97	93·4	597·26	2·23	97·4	692·04	2 52
85 5	441·62	1·73	89 5	515·53	1·97	93·5	599·49	2·23	97·5	694·56	2·52
85·6	443·35	1·74	89·6	517·50	1·98	93 6	601·72	2·25	97·6	697 08	2·53
85·7	445·09	1·75	89·7	519·48	1·98	93·7	603·97	2·25	97 7	699·61	2·54
85·8	446·84	1·75	89·8	521·46	1·99	93·8	606 22	2·26	97 8	702·15	2.55
85·9	448·59	1·75	89·9	523·45	2·00	93·9	608·48	2·26	97·9	704·70	2 56
86 0	450·34	1·76	90·0	525·45	2·00	94·0	610·74	2·27	98·0	707·26	2.56
86·1	452·10	1·77	90·1	527·45	2 01	94·1	613·01	2·28	98 1	709·82	2·57
86·2	453·87	1·77	90·2	529·46	2 02	94·2	615·29	2·29	98 2	712·39	2·58
86·3	455 64	1·78	90·3	531·48	2.02	94·3	617·58	2·29	98·3	714·97	2·59
86·4	457·42	1·79	90·4	533·50	2·03	94·4	619·87	2·30	98·4	717 56	2·59
86·5	459·21	1·79	90·5	535·53	2·04	94·5	622·17	2·31	98·5	720·15	2 60
86·6	461·00	1·80	90·6	537·57	2·04	94·6	624·48	2·31	98·6	722 75	2 60
86 7	462 80	1·80	90·7	539·61	2·05	94·7	626 79	2·32	98·7	725·35	2·61
86 8	464 60	1·81	90·8	541·66	2·06	94·8	629·11	2·33	98·8	727·96	2 62
86·9	466·41	1·81	90 9	543·72	2·06	94·9	631·44	2 34	98·9	730·58	2 63
87·0	468 22	1·82	91·0	545·78	2·07	95·0	633·78	2·34	99·0	733·21	2 64
87·1	470·04	1·83	91·1	547 85	2·07	95·1	636·12	2·35	99·1	735 85	2 65
87 2	471·87	1·83	91·2	549·92	2·08	95·2	638 47	2·36	99·2	738·50	2 66
87·3	473·70	1·84	91·3	552·00	2·09	95·3	640·83	2 36	99·3	741·16	2 67
87·4	475 54	1·84	91·4	554·09	2·10	95·4	643·19	2 38	99·4	743 83	2 67
87·5	477·38	1·85	91·5	556·19	2·10	95·5	645·57	2·38	99·5	746·50	2 68
87·6	479·23	1 85	91·6	558 29	2·12	95·6	647·95	2·39	99·6	749·18	2 69
87 7	481·08	1·86	91·7	560.39	2 12	95·7	650 34	2·39	99.7	751·87	2·70
87·8	482·94	1·87	91·8	562 51	2 12	95·8	652 73	2·40	99·8	754·57	2 71
87·9	484 81	1·88	91·9	564·63	2·13	95·9	655·13	2·41	99·9	757·28	2·72
88·0	486 69	1·88	92·0	566.76	2·13	96·0	657·54	2·41	100·0	760·00	2 73
88 1	488·57	1·88	92·1	568·89	2·14	96 1	659·95	2·42	100·1	762 73	2 73
88·2	490·45	1 89	92·2	571·03	2·15	96 2	662·37	2 43	100·2	765·46	2·74
88 3	492·34	1·90	92·3	573·18	2·16	96 3	664·80	2·44	100·3	768 20	2 75
88 4	494·24	1·91	92·4	575·34	2·16	96 4	667·24	2·45	100·4	771·95	2·76
88·5	496·15	1·91	92·5	577·50	2·17	96 5	669·69	2·46	100.5	773 71	2 77
88·6	498 06	1·92	92 6	579·67	2 17	96 6	672·14	2·46	100 6	776 48	2 78
88 7	499·98	1·92	92·7	581·84	2 18	96 7	674 60	2·47	100·7	779·26	2 78
88 8	501·90	1·92	92·8	584·02	2·19	96 8	677·07	2·48	100 8	782 04	2 79
88·9	503 82	1·94	92·9	586·21	2·20	96 9	679·55	2 48	100·9	784 83	2 80
89 0	505·76		93·0	588·41		97·0	682 03		101 0	787 63	

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The excavating instrument of *Pholas* and *Teredo* is formed of the anterior portion of the animal, in the surface of which are imbedded siliceous particles. The particles penetrating the skin give to it much the character of rasping-paper. The whole forms a rubbing surface, which being applied closely to the bottom of the cavity by the adhesion of the foot, enables the animal to rub down, and so penetrate shale, chalk, wood, or even the hardest limestones and marble.

Saxicava rugosa is also furnished with a rasping surface covered with siliceous particles. This surface, however, in this species is formed entirely of the anterior portion of the mantle, the margins of which being united are much thickened, forming a sort of cushion capable of considerable protrusion at the will of the animal. The foot is small, and passing through a much-constricted orifice, gives origin to a byssus, which anchors the shell close to the base of the excavation, and thus holds the rubbing apparatus in immediate contact with the part to be excavated.

58. *The Animal of the Spirula;* by J. E. GRAY, (Mag. Nat. Hist., xv, 1845, p. 257.)—Mr. GRAY states that the animal of the Spirula has hitherto been known only from a figure in the atlas of PERON and LESUEUR. He concludes from his examinations of a specimen in alcohol, (of which he gives figures,) that they resemble closely the cuttle-fish in external form, and will constitute a group of the Decapodous Cephalopods, forming a passage to the Octapodous; for like the latter, they are without a dorsal fin, and have a regularly chambered shell. The shell is enclosed with but a small part exposed, and is placed on the dorsal surface of the body with the spine bent towards the ventral sides.

"The examination of this animal confirms me in the opinion, which I expressed in the Synopsis of the British Museum, (1840, p. 149,) that the Ammonites, from their texture and the small size of the last chamber, are internal shells, and should be arranged with the Decapodous Cephalopods, being chiefly distinguished from the Spirulæ by the siphon, always on the dorsal margin of the whorls, and the septa being foliated on the edges."

59. *Adaptation of the Eye to Distinct Vision at Different Distances;* by Prof. FORBES, (Trans. Roy. Soc. Ed., xvi, 1.)—The crystalline lens,—for example, that of the ox,—is composed of a nearly spherical nucleus of compact, comparatively dense matter, of a hard pasty consistence; this nucleus gradually, yet rapidly passes into the gelatinous envelope, of a lenticular form, which has far less consistence and less resistance to external pressure, than the central spherule. Prof. FORBES thence suggests that any uniform pressure applied to the lens, such as might be communicated by the external muscles of the eye to the entire eye-ball, and propagated by hydrostatic pressure through the humors, would tend to make the exceedingly flattened ellipsoid of the eye approach in figure to the dense spheroidal nucleus; the obvious effect of this would be, to increase the curvature of the lens without changing its position, and thus render the rays from a near object more convergent. The effect probably proceeds from a simultaneous effort of the four *recti* muscles drawing the eye back in its socket.

IV. Botany.

60. *Number of Known Plants as given by Different Authors since Theophrastus, together with the supposed Total;* by R. B. Hind, (in Geographic Botany, Ann. Mag. Nat. Hist., xv, Jan. 1845, p. 12.)

	Known.	Supposed Total.
A. C. 300, Theophrastus, History of Plants, .	500	
A. D. 70, Pliny, History of the World, . .	1,000	
1580, Dodonæus, Stirpium Historia, . .	1,330	
1623, Banhin, Pinax, ...	6,000	
1690, Ray, ...		18,000
Tournefort, ...	6,000	
1753, Linnæus, Species Plantarum, 1st ed.,	7,300	
1762, 2d ed.,	8,800	
1796, Gmelin, Systema Vegetabilium, .	16,635	
1806, Persoon, Enchiridium, . . .	27,000	
Humboldt, ...		44,000
1814, Brown, Flinders' Voyage, . .	37,000	
1820, De Candolle, Théorie Elémentaire, .	50,000	100,000
1824, Prodromus, . .	50,000	
1827, Sprengel, ...	37,000	
1830, Balbi, Geographie, ...		80,000
1835, Lindley, Introduction to Botany, .		86,000
1845, R. B. Hind, (supposing, for reasons which he states, that one third yet remains to be discovered,		134,000

Mr. Hind gives the following as their probable distribution:

		Square Miles.
Europe, ...	11,200	2,793,000
Asia, ...	36,000	12,118,000
Africa, ...	25,200	8,500,000
North America, ...	14,400	11,146,000
South America, ...	40,000	
Australasia, ...	7,200	3,100,000
	134,000	37,657,000

61. *Potato disease*, (L'Institut, xiii, ann. 1845, pp. 325, 328, 343.) —The origin of this disease is traced by M. Payen, as has been done by others, to a cryptogamic vegetation propagating within the tubes. The fungus, whose spirules have followed the liquids infiltrated about the cortical parts especially, and sometimes the axis, develops in the cellules minute anastomosing filaments, which are nourished by the oily ingredients and enclosed fecula. Passing from one cellule to another, they bind the whole together so that the texture is not destroyed at the boiling point. The fibres growing outward towards the exterior sur-

face, attack all the azotized, oily and amylaceous substances which they can assimilate; the fecula or starch is gradually disaggregated, dissolved and absorbed, presenting a novel series of changes in the history of this substance. A humid state of the weather is believed to hasten the development of the potato fungus.

M. POUCHET points out four stages in the process of changes. In the *first* period, the tissues of the potato are hardly discolored; small clear brownish granules are distinguished at the surface of the membrane constituting the cellular tissue, especially in the intercellular spaces; the fecula of the cellules is untouched. In the *second*, the tissues are brownish; the brown granules upon the surface of the cellules have multiplied, and become deeper colored; the fecula is still in a healthy state. In the *third*, the granules have become of a deeper brown color, and the cellules gradually become broken into shreds, the starch or fecula being not yet at all altered. In the *fourth*, the tissues are soft and grayish; the cellular membranes are reduced to brown granulations resulting from the walls of the cellules and the granules on their surface. The starch grains remain "*dans leur integrité*." M. POUCHET does not believe that this disease results from the growth of a fungus (*Botrytis infestans*,) which M. MOREN has detected upon the leaves of the potato, and regards as its origin. The affection is considered analogous to that which destroys cellulous fruits, such as apples, pears, &c.; and a direct microscopic comparison is stated to favor the view.

The prevailing opinion and most observations are opposed to the views of M. POUCHET. M. PAYEN has compared by analyses the healthy and diseased potato, and found that the fecula has actually been diminished 20 per cent.

V. GENERAL PHYSICS.

62. *Temperature of the Mediterranean;* (extracted from a Memoir on the Temp. of the Medit., by M. AIME, Ann. de Chim. et de Phys., 3d ser., XV, 1845, p. 6.)—M. AIME arrives at the following conclusions from numerous observations on the temperature of the Mediterranean.

1. Near the coast the temperature during the day is higher than in the open sea, and at night lower.

2. The mean surface temperature for the year is nearly that of the air; in spring and summer it is less than that of the air, and in autumn and winter, greater. The surface temperature is never below 50° Fah.; and sometimes reaches to 79°.

3. The diurnal variation ceases to be appreciable at 20 yards, and the annual variation at 350 to 430 yards.

4. On a morning after a clear and calm night, the temperature of the surface is colder than that of the water several yards below.

5. The minimum temperature of the depths of the Mediterranean is equal to the mean temperature of the winter.

In the southern part the temperature decreases through the year, to a depth of 35 to 440 yards. In the northern part it increases during the winter to that depth. It seems consequently that the cold temperature below depends on the descent of the upper cold strata during winter, and not on the entrance of the waters of the ocean.

63. *Boiling point of Water at different heights;* by M. V. REGNAULT, (extracted from Ann. de Chim. et de Phys., XIV, 1845, 196.)—The following table has been made out by M. V. REGNAULT to aid in determining heights by the boiling point of water, a method recommended alike by its simplicity and the portable character of the instrument, and now very commonly adopted in preference to the barometer. The calculated results are shown to vary less than half a line in the height of the barometric column from those by observations.

M. REGNAULT states that the thermometer should be made of the best crystal glass, as others dilate irregularly. They are graduated from 75° to 100° C., (equivalent to 167° to 212° Fah.,) and the following is the method adopted for this purpose. As much mercury is introduced in the usual way as will stand one third up the stem when placed in melting ice; this point (designated n) is accurately marked. The tube is then placed alongside of another graduated thermometer in a large vessel full of water, kept agitated, and exactly at 20° C. (68° Fah.); and the height of the mercury (n') corresponding to the degree of temperature (t) indicated on the graduated scale is noted. $\frac{n'-n}{t}$ will then give the value of a degree. A portion of the mercury is next expelled, so that it will reach towards the top of the tube when in boiling water, and the tube is closed as usual. It is then placed in the vapor of boiling water under a pressure of about 760 millimetres, and the point at which the mercury stands (n'') is noted, and also the exact temperature (T). The value of a corrected degree may then be obtained by the following formula:—

$$\frac{\frac{n'-n}{t}+\frac{1}{6480}(n''-n)}{1+\frac{T}{6480}}$$

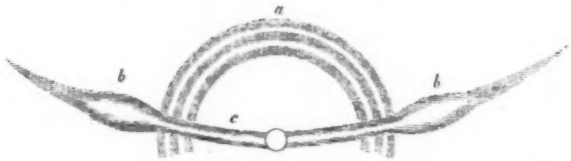
The instrument is made of brass tubes that slide into one another like a spy-glass, and is but six inches long when closed up, but may be drawn out to a length of fifteen inches. The lower part, which contains the water to be heated, is one and one-eighth inches in diameter. This is inserted in a large cylindrical vessel, which has a lamp at bottom. The thermometer is dropped down into the vapor just above the surface of the boiling water.

The table gives for each tenth of a degree Centigrade, between 85° and 101°, the amount of barometric pressure reduced to 0°, corresponding to the temperatures observed, of boiling water. The calculations are in French measures. A millimetre = .03937 English inches. The Centigrade scale is used in the table.

Table of the tension of the vapor of water in millimetres, from 85 *to* 101 *degrees* C.

Degree. °	Tension. *mm*	Diff.	Degree. °	Tension. *mm*	Diff.	Degree. °	Tension. *mm*	Diff.	Degree. °	Tension. *mm*	Diff.
85·0	433·04	1·71	89·0	505·76	1·94	93·0	588.41	2·20	97·0	682·03	2·49
85·1	434·75	1·71	89·1	507·70	1·95	93·1	590·61	2·21	97·1	684 52	2·50
85·2	436·46	1·71	89·2	509·65	1·95	93·2	592·82	2·22	97·2	687·02	2·51
85·3	438·17	1·72	89·3	511·60	1·96	93·3	595·04	2·22	97·3	689·53	2·51
85·4	439·89	1·73	89·4	513·56	1·97	93·4	597·26	2·23	97·4	692·04	2·52
85·5	441·62	1·73	89·5	515·53	1·97	93·5	599·49	2·23	97·5	694·56	2·52
85·6	443·35	1·74	89·6	517·50	1·98	93·6	601·72	2·25	97·6	697·08	2·53
85·7	445·09	1·75	89·7	519·48	1·98	93·7	603·97	2·25	97·7	699·61	2·54
85·8	446·84	1·75	89·8	521·46	1·99	93·8	606 22	2·26	97·8	702·15	2·55
85·9	448·59	1·75	89·9	523·45	2·00	93·9	608·48	2·26	97·9	704·70	2·56
86·0	450·34	1·76	90·0	525·45	2·00	94·0	610·74	2·27	98·0	707·26	2.56
86·1	452·10	1·77	90·1	527·45	2·01	94·1	613·01	2·28	98 1	709·82	2·57
86·2	453·87	1·77	90·2	529·46	2·02	94·2	615·29	2·29	98 2	712·39	2·58
86·3	455 64	1·78	90·3	531·48	2.02	94·3	617·58	2·29	98·3	714·97	2·59
86·4	457·42	1·79	90·4	533·50	2·03	94·4	619·87	2·30	98·4	717 56	2·59
86·5	459·21	1·79	90·5	535·53	2·04	94·5	622·17	2·31	98·5	720·15	2 60
86·6	461·00	1·80	90·6	537·57	2·04	94·6	624·48	2·31	98·6	722 75	2 60
86 7	462·80	1·80	90·7	539·61	2·05	94·7	626 79	2·32	98·7	725·35	2·61
86 8	464 60	1·81	90·8	541·66	2·06	94·8	629·11	2·33	98·8	727·96	2·62
86·9	466·41	1·81	90 9	543·72	2·06	94·9	631·44	2 34	98·9	730·58	2 63
87·0	468·22	1·82	91·0	545·78	2·07	95·0	633·78	2·34	99·0	733·21	2·64
87·1	470·04	1·83	91·1	547 85	2·07	95·1	636·12	2·35	99·1	735 85	2 65
87 2	471·87	1·83	91·2	549·92	2·08	95·2	638 47	2·36	99·2	738·50	2 66
87·3	473·70	1·84	91·3	552·00	2·09	95·3	640·83	2 36	99·3	741·16	2 67
87·4	475 54	1·84	91·4	554·09	2·10	95·4	643·19	2 38	99·4	743·83	2 67
87·5	477·38	1·85	91·5	556·19	2·10	95·5	645·57	2·38	99·5	746·50	2 68
87·6	479·23	1 85	91·6	558 29	2·10	95·6	647·95	2·39	99·6	749·18	2 69
87 7	481·08	1·86	91·7	560.39	2·12	95·7	650 34	2·39	99.7	751·87	2·70
87·8	482·94	1·87	91·8	562 51	2 12	95·8	652 73	2·40	99·8	754·57	2 71
87·9	484·81	1·88	91·9	564·63	2·13	95·9	655·13	2·41	99·9	757·28	2·72
88·0	486 69	1·88	92·0	566.76	2·13	96·0	657·54	2·41	100·0	760·00	2 73
88 1	488·57	1·88	92·1	568·89	2·14	96 1	659·95	2·42	100·1	762 73	2 73
88 2	490·45	1·89	92 2	571·03	2·15	96 2	662·37	2 43	100·2	765·46	2·74
88 3	492·34	1·90	92·3	573·18	2·16	96·3	664·80	2·44	100·3	768 20	2 75
88 4	494·24	1·91	92·4	575·34	2·16	96 4	667·24	2 45	100·4	771·95	2·76
88 5	496·15	1·91	92·5	577·50	2 17	96·5	669·69	2·46	100.5	773 71	2 77
88 6	498 06	1·92	92 6	579·67	2 17	96 6	672·14	2·46	100·6	776 48	2 78
88 7	499·98	1·92	92·7	581·84	2·18	96 7	674 60	2 47	100·7	779·26	2 78
88 8	501·90	1·92	92·8	584·02	2·19	96 8	677·07	2·48	100 8	782 04	2 79
88·9	503 82	1·94	92·9	586·21	2·20	96 9	679·55	2 48	100·9	784·83	2 80
89 0	505·76		93·0	588·41		97·0	682 03		101 0	787 63	

64. *Remarkable Paraselene witnessed on the night of the* 19*th April*, 1845; by Prof. CHAS. G. PAGE, M. D., (in a letter to Prof. SILLIMAN.) —Parhelia of varied forms are often seen in this region, and more particularly late in the autumn; but it has never been my good fortune to witness a distinct paraselene, until the above period. Being merely a casual observer of the heavens, I bear record of such phenomena with diffidence, and hoped to have seen ere this time, some faithful notices of this rare appearance by those who explore the heavens with



more than the unassisted eye. The above sketch agrees in several particulars with one given by Mr. R. W. BIRT in the Philosophical Magazine, No. 121, of a paraselene witnessed by him on the 6th May, 1841. The halos and luminous portions were formed upon a light cloud of the class cirro-stratus, first making their appearance about half past 9 P. M., and lasting one hour. The moon was nearly full, and high in the heavens. There were three distinct concentric halos, of the general prismatic character of the large halo or circle so often seen around the moon, the outermost of which presented a diameter of about one half that of the large halos. The halos during the whole time extended only a very little beyond a semicircle. At their uppermost point (*a*) there appeared a diffused luminosity, too faint to define by representation, but at the points *b*, *b*, (and what seemed to be extraordinary)—*without* the circle of the halos, there were two brilliant oval spots, not appearing as defined images of the moon, but bearing about the same relation to the moon in intensity of light, as parhelia do to the sun. From these, there extended for some distance a nebulous pencil, as seen in the figure. A belt of light curved somewhat as represented in the figure, extending from the moon on either side, seemed to form the base of the arch made by the halos, but on close observation it was found that the halos appeared faintly for a short distance below the belt. In the paraselene described by Mr. BIRT, the images of the moon were directly upon or coincident with the halos, but were represented as of a lozenge shape. The circle of halos in the same case was also incomplete, and the belt of light subtending the semicircle of halos, was similar to that I have represented.

Washington, D. C., Sept. 18, 1845.

65. *Recent Progress of Magnetical and Meteorological Science,—being notices of several new publications both American and Foreign on these subjects.*

(1.) *Observations made at the Magnetical and Meteorological Observatory at Toronto in Canada*, 1840, 1841, *and* 1842. 4to.

We are beginning to reap the fruits of the grand system of magnetical and meteorological observations which was commenced in 1840. Several volumes of observations have already appeared, and we shall look for others in due time. Above we have given the title of a thick quarto volume, containing at large the observations of three years at Toronto. It is a splendid volume, and will prove a lasting monument of the liberality of the British government.

The Toronto Observatory is situated in latitude 43° 39′ 35″ N., longitude 79° 21′ 30″ W., and is 108 feet above the surface of Lake Ontario. The main observatory has two apartments—one 50 feet by 20 for the instruments, the other 18 feet 12 for a computing room. The observatory was provided with instruments for measuring the declination and inclination of the magnetic needle, the horizontal and vertical force, and also with a complete set of meteorological instruments. We regret that we can only find room for a few of the results of these observations.

The mean declination of the needle for 1841, was 1° 14′·35 west.
" " " 1842, " 1° 18′·95

Annual increase of west declination, 4′·6.

The mean inclination of the needle for 1841, was 75° 17′·0
" " " 1842, " 75° 16′·4

The results for the two years are so nearly identical, as to prove that the annual change of inclination must be exceedingly small, and even to leave it uncertain in what direction this change is taking place.

The magnetic observations on the term days are all projected in curves; and side by side are placed for comparison the curves at Boston and Philadelphia. The correspondence in the motions of the needle at these three places was generally quite remarkable; all the larger movements at either station, and frequently also the most minute ones, being exactly copied at each of the other stations.

The mean temperature of 1841, was . .		43°·9
" " 1842, " . .		44°·8
The greatest heat of the two years, was	91°·7	
The greatest cold " " "	—5°·2	
Range of the thermometer, . .	96°·9	
The maximum of the barometer, was .		30·417
The minimum " " "		28·672
Range in two years, ...		1·745

The least degree of humidity was 22, the point of saturation being represented by 100.

The following is the mean result of the barometric observations for two years.

	6 A. M.	8.	10.	noon.	2 P.M.	4.	6.	8.	10.	midnight	2A.M	4.
Gaseous atmosphere,	29·379	·375	·364	·333	·310	·311	·326	·348	·357	·361	·364	·370
Aque'us vapor,	·241	·259	·271	·281	·285	·279	·269	·256	·250	·243	·238	·234
Total pressure,	29·620	·634	·635	·614	·595	·590	·595	·604	·607	·604	·602	·604

The diurnal pressure of the gaseous atmosphere has one maximum which occurs about the coldest hour of the day, and one minimum which occurs about the warmest hour of the day. The elastic force of the vapor has also one maximum which occurs at 2 P. M. and one minimum at 4 A. M. The sum of these two pressures however exhibits two daily maxima, viz. at 10 A. M. and P. M.; and two daily minima, viz. about 3 or 4 A. M. and P. M. Thus this knotty question respecting the diurnal oscillations of the barometer has been beautifully resolved by simply *interrogating nature.*

The pressure of the wind resolved in the direction of the four cardinal points, was as follows:

Date.	N.	E.	S.	W.
1841,	1832·6 lbs.	957·2	747·4	1741·4
1842,	2544·4	1386·2	1293·3	2697·4

The mean direction of the wind is accordingly N. 41° 53′ W. The greatest pressure observed during the two years was 15 pounds per square foot, Feb. 3, 1841.

The amount of rain in 1841, was . . 36·58 inches.
" " " 1842, " . . 42·80 "

(2.) *Observations in Magnetism and Meteorology, made at Makerstoun, Scotland, in the Observatory of Sir* T. M. BRISBANE, 1841 *and* 1842.

These are the fruits of a private observatory established by General BRISBANE in concert with those which were endowed by the governments of Europe. The observatory is situated in latitude 55° 34′ 45″ N., longitude $0^h\ 10^m\ 3^s{\cdot}5$ W.

According to these observations, the mean declination in 1842 was 25° 28′·56 W. Yearly decrease of west declination, 4′·07.

Greatest declination observed, . .	27° 1′·56
Least " " . .	24° 54′·28
Range in 17 months, ...	2° 7′·28

Mean magnetic dip for 1842, 71° 11′·95. Yearly decrease of dip, 4′·83.

Greatest height of the barometer, . .	30·304
Least " " " . .	28·262
Range in 17 months, ...	2·042

The amount of cloudiness appears to be very high; but as the observations only embrace a period of eight months, perhaps they are not a fair representation of the climate.

The average amount of rain in a period of 11 years, was 24·565 inches, as determined by a gauge placed six feet above the soil.

(3.) *Annuaire Magnetique et Meteorologique de Russie, par* A. T. KUPFFER, 1842. 4to. [The 7th of the Series.]

In this imperial Annuaire, worthy of the Cesars, we find meteorological observations made *every hour of the day*, at St. Petersburg, Barnaoul, Nertchinsk, Catherinenburg, and Sitka; and observations made *eight hours* of the day at Zlatouste, Bogoslowsk, Lougan, and Peking; observations which are more valuable, as several of these places are situated in a quarter of the globe hitherto but little known. Most of these stations have also furnished magnetic observations. The following is a summary of some of the results for 1842.

Places.	Latitude.	Longitude.	Dip.	Declination.	Annual variation.
St. Petersburg,	59° 56′ N.	30° 19′ E.	71° 0′·3	6° 21′·1 W.	—4′·9
Catherinenburg,	56 51	60 34	69 53′·5	6 38′·9 E.	
Barnaoul,	53 20	83 56	70 7′·2	8 24′·8 E.	
Nertchinsk,	51 56	116 31	67 7′·9	3 46′·9 W.	
Peking,	39 54	116 26	55 42′·0		
Kazan,	55 48	49 7	68 23′·0		

The following is a summary of the observations on the pressure of the air.

ST. PETERSBURG.	Noon.	1 P.M.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Dry air, . .	29·870	·867	·864	·863	·865	·866	·870	·872	·873	·874	·875	·875
Vapor, . .	·117	·117	·118	·118	·116	·115	·113	·113	·111	·110	·109	·108
Total, . .	29·987	·984	·982	·981	·981	·981	·983	·985	·984	·984	·984	·983
BARNAOUL.												
Dry air, . .	29.432	·433	·434	·437	·439	·438	·438	·438	·438	·436	·437	·439
Vapor, . .	·106	·105	·104	·101	·099	·097	·095	·093	·091	·090	·089	·087
Total, . .	29·538	·538	·538	·538	·538	·535	·533	·531	·529	·526	·526	·526
CATHERINENBURG.												
Dry air, . .	28·883	·884	·886	890	892	·895	·898	·900	·900	·900	·898	·898
Vapor, . .	·090	·090	·090	·089	089	·089	·089	·088	·087	·086	·086	·085
Total, . .	28·973	·974	·976	·979	981	·984	987	·988	·987	·986	·984	·983
SITKA.												
Dry air, . .	29 804	·801	·802	802	·801	·802	·804	·809	·812	813	·815	·814
Vapor, . .	·132	·131	·129	128	·126	125	·123	121	·120	·120	119	·118
Total, . .	29·936	·932	·931	·930	·927	927	·927	·930	·932	·933	·934	932

St. Petersburg.	Midn't.	1 A.M.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Dry air, . .	29·874	·873	·871	·869	·868	·866	·866	·867	·870	·871	·869	·868
Vapor, . .	·107	·106	·105	·105	·106	·107	·109	·112	·112	·114	·116	·116
Total, . .	·981	·979	·976	·974	·974	·973	·975	·979	·982	·985	·985	·984
Barnaoul.												
Dry air, . .	29·438	·438	·438	·436	·435	·435	·432	·428	·425	·421	·416	·416
Vapor, . .	·089	·091	·095	·100	·104	·106	·109	·111	·112	·113	·114	·112
Total, . .	29·527	·529	·533	·536	·539	·541	·541	·539	537	·534	·530	·528
Catherinenburg.												
Dry air, . .	28·898	·897	·896	893	·892	·892	890	·889	·887	·884	·882	880
Vapor, . .	·084	·084	·084	·087	·089	·090	·091	·091	·092	·092	·092	092
Total, . .	28·982	·981	·980	·980	·981	·982	·981	·980	·979	·976	·974	972
Sitka.												
Dry air, . .	29·810	·808	·806	·804	·802	·803	·805	·807	807	·807	·807	·806
Vapor, . .	·117	·117	·117	·119	·121	·125	·127	·129	·131	·133	·133	·133
Total, . .	29·927	·925	·923	·923	·923	·928	932	·936	·938	·940	·940	·939

According to all of these observations, the elastic force of the vapor of the air has one daily maximum and one daily minimum.

According to the St. Petersburg obs. the max. occurs 2½ P. M., the min. 2½ A. M.
" " Barnaoul, " " " 10 A. M., " 11 P. M.
" " Catherinenburg, " " " 9½ " " 1 A. M.
" " Sitka, " " " 10 " " 1 "

At St. Petersburg, the greatest heat occurs at 2 P. M., greatest cold at 3 A. M.
At Barnaoul, " " " 9½ A. M., " " 11 P. M.
At Catherinenburg, " " " 10 " " " 1 A. M.
At Sitka, " " " 10½ " " " 1 "

The minimum pressure of the vapor occurs at almost the precise instant of minimum temperature, and so also with the maxima.

The pressure of the gaseous atmosphere has one daily maximum at Catherinenburg about 8 P. M. and one daily minimum at 10 A. M., and the motion is throughout extremely regular. At the other three stations there is a maximum about the time of greatest cold, and a minimum about the time of greatest heat; but there are also subordinate maxima and minima. Possibly the direction of the wind may have some influence in producing these irregularities.

The following is the amount of rain and snow during the year.

St. Petersburg,	18·5 inches.	Zlatouste,	14·67 inches.
Barnaoul,	19·13 "	Bogoslowsk,	15·98 "
Nertchinsk,	13·81 "	Lougan,	15·47 "
Catherinenburg,	11·78 "	Peking,	27·98 "

(4.) *Observations Meteorologiques faites à Arkangel.* Lat. 64° 32′, long. 40° 34′ E.; *et communiquées par* M. Kupffer.

This volume contains observations of eighteen and a half years, from June, 1813, to December, 1831; and they are of very great importance as coming from so high a latitude.

The greatest height of the barometer for the entire period was 30·97 inches. Least height, 27·97 inches. Range in 18½ years, 3·00 inches.

The mean temperature of the entire period, was +0°·68 Reaumur, =33°·53 Fahrenheit.

	Reaumur.	Fahrenheit.	
The highest temp. was	32°·5 =	105°·12,	July 2, 1818.
The lowest " "	−35°·0 =	−46°·75,	Jan. 1, 1814. Jan. 18, 1828.
Range of 18 years,	67°·5 =	151°·87	

In two instances the thermometer is said to have sunk to −35°·0, once to −33°·8, twice to −31°·5, and twice to −31°·0. The observations were all made with a mercurial thermometer, and mercury freezes at −31° Reaumur; that is, according to these observations the temperature fell repeatedly below the point of congelation of mercury.

The following table shows the influence of wind upon temperature.

With a north wind,				the mean temp. was	−1°·1 Reaum.
"	northwest wind,	"	"	"	+1°·0 "
"	west "	"	"	"	+1°·8 "
"	southwest "	"	"	"	+2°·8 "
"	south "	"	"	"	+2°·6 "
"	southeast "	"	"	"	+0°·8 "
"	east "	"	"	"	−1°·4 "
"	northeast "	"	"	"	−2°·2 "

The coldest wind is from the northeast, and the warmest from the southwest.

The following table shows the number of times the wind was observed to blow from each of the cardinal points.

North, . . .	2350	Southeast, . .	2760
Northwest, . .	2023	East, . . .	2239
West, . . .	3007	Northeast, . .	1426
Southwest, . .	2757	Calm, . . .	1784
South, . . .	1969		

The mean direction deduced from these numbers, is S. 47° 42′ W.; but the mean progress in that direction is *less than one twelfth* of the entire velocity of the wind—so that at Arkangel the wind has *no prevalent direction.* The atmosphere oscillates to and fro, and the inhabitants inhale the same particles of air from generation to generation.

(5.) *Ueber das Magnetische Observatorium der Sternwarte bei München.—Bestimmung der Horisontal Intensitat der Erdmagnetismus.—Resultate der Magnetischen Beobachtungen in München*, 1840, 1841, 1842; von Dr. J. Lamont.

The first of the above named pamphlets contains a particular description of the Magnetic Observatory at Munich; the second contains a treatise on the absolute determination of the horizontal intensity of the earth's magnetism; and the third contains the results of three years magnetic observations.

The mean declination of the magnetic needle at Munich—

For 1841, was	16° 54′·4
1842, "	16° 48′·0
Annual decrease of west declination, .	6′·4

(6.) *Proceedings connected with the Magnetical and Meteorological Conference held at Cambridge, (Eng.) in June*, 1845.

From this pamphlet we learn that the British government have resolved to equip a new Arctic expedition under the command of Sir JOHN FRANKLIN, with a view to the completion of the discovery of a northwest passage. The expedition, consisting of the *Erebus* and the *Terror*, furnished with steam-power, and provided with all the instruments necessary for the prosecution of magnetic and meteorological observations, sailed during the summer of 1845.

A new magnetic observatory has recently been established in British Guiana; and an observatory is in contemplation at Colombo, in Ceylon.

Lieut. LEFROY has completed his magnetic survey of an important part of North America. He has determined the three magnetic elements at above 100 stations within the isodynamic oval of 1·7.

Lieuts. MOORE and CLERK sailed in the *Pagoda*, Jan. 9th, 1845, from Simon's Bay, on the magnetic survey of that part of the Atlantic Ocean left unexplored by Sir JAMES ROSS. She crossed the Antarctic circle on the 5th of February, in long. 30° 45′ E., and her furthermost point south was 67° 50′. She returned to the Cape, via St. George's Sound, Australia, on the 20th of June last, having sailed over more degrees of longitude within the sixtieth parallel than any other single vessel. As the second term of three years, during which the magnetic and meteorological establishments of the British and other governments were to be continued, would expire with the year 1845, the magnetic committee of the British Association, about a year since, entered into an extensive correspondence with foreign meteorologists on the subject of a continuance of the observations. Several distinct questions were proposed, upon which opinions were requested. Replies were received from a large number of individuals, generally expressing the desire that the observations might be continued, with some modifications. The most eminent persons in these sciences from all parts of the world, were invited to a conference on the subject, which was held at Cambridge in June last. Among others, there were present at the conference, Messrs. KUPFFER, KREIL, ERMAN, DOVE, BOGUSLAWSKI and LEUFTENBERG. The result of this conference was the adoption of resolutions recommending the continuance of observations upon substantially the present system, for another period of three years. It is to be hoped that this recommendation will be generally concurred in, and that the coöperation during the coming three years will be more general and enthusiastic than ever.

(7.) *First Report on Meteorology;* by JAMES P. ESPY.

This report consists chiefly of maps of the United States, exhibiting the direction of the wind, state of the barometer, thermometer, &c., on various days in January, February and March, 1843. There are twenty nine of these maps, which contain a vast amount of valuable information. They clearly indicate the proper course to be pursued if we would arrive at a complete knowledge of the laws of storms. Several important generalizations deduced from these observations, accompany the report. The following are some of them.

Storms in the United States travel from west to east; they are accompanied with a depression of the barometer near the centre of the storm; they travel about 36 miles per hour; in great storms, the wind for several hundred miles on both sides of the line of minimum pressure, blows towards that line, directly or obliquely. The force of the wind is in proportion to the suddenness and greatness of the barometric depression. In all great and sudden depressions of the barometer, there is much rain or snow; and in all sudden and great rains or snows, there is a great fluctuation of the barometer.* Many storms are of great and unknown length from north to south, while their east and west diameter is comparatively small. There is generally a lull of wind at the line of minimum pressure, and sometimes a calm. When the wind changes to the west, the barometer generally begins to rise. There is generally but little wind near the line of maximum pressure, and on each side of that line the winds are irregular, but tend outwards from that line. The fluctuations of the barometer are generally greater in the northern than in the southern parts of the United States, and greater in the eastern than in the western parts.†

(8.) *Magnetical and Meteorological Observations made at Washington;* by Lieut. J. M. GILLISS. 8vo., pp. 648.

The instruments used in these observations were a declinometer and dip circle by SIMMS, a barometer, several thermometers, hygrometer, rain gauge, &c. The magnetic observations embrace two years, from July, 1840, to June, 1842.

The mean declination for 1840–1, was	1° 20′ 12″·7	W.
" " 1841–2, "	1° 23′ 56″·9	
Annual variation, . . .	3′ 44″·2	
The minimum declination for each day occurs at	8h. 6m.	A. M.
Maximum " " "	1 33	P. M.
A secondary minimum occurs . . .	9 46	"
" maximum " . . .	2 10	A. M.

* There are some remarkable cases of great rains with little motion of the barometer.

† We should like to see the evidence of the second part of this statement.

The mean diurnal variation for summer, is	.	10′ 4″·1
" " autumn,	. .	6′ 21″·9
" " winter,	. .	4′ 36″·3
" " spring,	. .	8′ 10″·7
The mean dip for 1840–1, was	. . .	71° 20′·2
" 1841–2,	. . . .	71° 18′·0

The meteorological journal embraces four years, from July, 1838, to June, 1842.

The maximum of the barometer for two years, was	30·810
Minimum " "	29·074
Range, ...	1·736
The maximum temperature was . . .	103°·0
Minimum "	—4°·5
Range for four years, ...	107°·5

Mean temperature of Washington from four years, 53°·97.

The following is the result of four years observations of the winds:

No. of observations from the	South, . .	32·7
" "	Southwest, .	56·2
" "	West, . .	38·4
" "	Northwest, .	70·3
" "	North, . .	26·3
" "	Northeast, .	43.2
" "	East, . .	18·9
" "	Southeast, .	20·3
" "	Calm, . .	52·8

Mean direction of the wind, N. 71° 51′ W.

Mean annual amount of rain, 41·21 inches.

The subject of meteorology is every year attracting increased attention both in this country and in Europe, and the perseverance of its cultivators has been rewarded with considerable success. We have advanced so far that we can see very clearly what is wanted to ensure further progress. A vast number of meteorological journals are kept in the United States, and a great amount of industry expended upon them. We need however more uniformity of system—in many cases better instruments, and in some quarters a great increase of observers. In order to be able to investigate satisfactorily the phenomena of a great storm, we need observations throughout its entire extent, from stations not more than fifty miles from each other,—observations with good instruments and upon a uniform plan. Is this idea too gigantic to be realized? Let us see what materials we have to depend upon.

I. The general government has manifested a very commendable zeal on this subject. Observations of the thermometer have long been made at some of the military posts, but recently their number has been much

increased, and the observations made much more valuable by the addition of barometers, &c. This system might very profitably be extended still further, so as to include forts, light-houses, navy yards, arsenals, &c.; and those stations are the more important, as many of them are upon the very outskirts of civilization, where it would be difficult to obtain observations from any other source.

II. Two of the state governments, viz. New York and Pennsylvania, have set a most praiseworthy example in their encouragement of meteorological observations. For twenty years the state of New York has required a register to be kept at each of the academies subject to the Board of Regents. These observations have furnished results of the greatest value. Nevertheless it is time that the system in that state was revised. The observations are incomplete without a barometer, and it is desirable that the stations be distributed more uniformly over the state. We sincerely hope that other states will emulate the noble examples of New York and Pennsylvania. Many of them might do it without the least inconvenience, and the results of the observations would be interesting to every member of the community.

III. Our main reliance in every scientific enterprise must be on private zeal. This zeal in some parts of the country is still to be awakened, and where zeal is already awakened, it needs to be directed. We want more observers from the north of New England, and every where throughout the South and West. Here is a great work which naturally devolves upon the philosophical societies. Let every philosophical society in the United States, within the sphere of its influence, strive to organize a company of observers occupying the whole country at intervals of fifty miles; and after deciding upon the best plan of observations, endeavor to persuade every observer to adopt the same system.

IV. The British government have established a noble observatory at Toronto. Subordinate stations might be established at every military post in Canada, at a trifling expense, which would powerfully contribute to the promotion of meteorology. It is important to determine the *limits* of our great storms, but they very frequently extend northward to an unknown distance beyond the limits of the United States. Hence we need the coöperation of the British government, and we flatter ourselves that when the importance of the subject is fully presented to their consideration, they will respond to the call with that discriminating liberality which has ever characterized their patronage of science.

[Our magnetical and meteorological summary having extended to an unexpected length, has excluded some *astronomical* and other scientific notices which were intended for this number. They shall however appear in our next.—*Eds.*]

MISCELLANEOUS ITEMS.

66. At the Italian Scientific Association for 1844, VON BUCH exhibited a geological map of Sicily made by M. HOFFMANN, and observing that the granites of Calabria have a relation to those of Sicily, deduced that the Straits of Messina must have been produced at the period of the granitic eruptions; and consequently that Sicily and Calabria were never united.—*L'Institut, No.* 603, 1845, *p.* 260.

67. The *Geological Society of France* commenced their extraordinary session for the past year on the 14th of September at Avallon. The place was selected on account of the great geological interest of the country around.

68. *Expedition to Siberia*, (L'Institut, No. 606, 1845, p. 257.)—M. MIDDENDORFF is engaged on an expedition into Siberia, and has already made extensive observations and collections towards elucidating the natural history of that country.

69. *Rail Road Excavations in England.*—The sections made through the country are not only bringing to light interesting geological facts, but curious historical monuments. The line of railway from Brighton to Lewes cuts directly through the ancient Priory destroyed by Henry VIII, and across the site of the high altar and the leaden coffins of *William of Warren and his countess Gundreda*, daughter of William the Conqueror, and the skeletons when disinterred were found in very tolerable preservation. They are to be placed in Southover church under the sepulchral tablet of Gundred, which had been thrown by when the Priory was destroyed, and was made use of (the smooth side upward) in the tomb of a country gentleman, EDWARD SHIRLEY, in a village church-yard seven miles from Lewes; now the bones will be again covered by the Latin laudatory hexameters.*

70. Professor BALFOUR, late of the University of Glasgow, has been elected to the botanical chair in the University of Edinburgh, vacated by the death of the excellent Dr. GRAHAM. We learn that the professorship at Glasgow, relinquished by Dr. BALFOUR, has been offered to that very able botanist, G. A. WALKER ARNOTT, Esq. of Arlary, Kinrosshire.

71. *Identity of Light, Heat and Electricity*, (Athenæum, No. 941.) —Mr. FARADAY, on the 2d of Nov. last, announced, at a meeting of the Council of the Royal Institution, a very remarkable discovery; which appears to connect the imponderable agencies yet closer together, if it does not indeed prove that light, heat and electricity are merely

* In the history of the antiquities of Lewes by HORSFIELD, we find a drawing of Gundreda's tomb; the slab referred to above was beautifully and deeply sculptured both for the inscription and the ornaments.—EDS.

modifications of one great universal principle. This discovery is, that a beam of polarized light is deflected by the electric current, so that it may be made to rotate between the poles of a magnet; and, as we understand, the converse of this, that electro-magnetic rotations may be produced by the agency of light. Thus the problem which has disturbed science for a long period as to the power of magnetizing iron by the sun's rays, as stated by Mrs. SOMERVILLE, MORRICHINI and others, receives satisfactory elucidation from the indefatigable industry of Mr. FARADAY. Already has he proved the identity of machine, chemical, magnetic and animal electricity; and now, advancing a step higher in the inquiry, he finds the most ethereal principle with which we are acquainted capable of producing phenomena which have hitherto been regarded as the exclusive property of ponderable bodies only. Light, the subtile agent of vision, the source of all the beauty of color, is now shown to have some close relation with electricity, to which has long been referred many of the vital functions. As life and organization exist only where there is light, this discovery of Mr. FARADAY's would appear to advance us towards some knowledge of those physiological phenomena which are the most recondite subjects of science.

72. *Note on Prof. Twining's Article.*—We have, on account of its ingenuity and plausibility, inserted (at p. 89) Prof. TWINING's solution of the much vexed problem concerning parallel lines. We ought, however, to state that a scientific friend to whom we referred the paper, does not consider the course of reasoning satisfactory, and we have thought best to insert here the remarks which he has furnished.—*Eds.*

The reasoning in question is certainly of a novel and ingenious character, but is not free from steps that are objectionable. That there must be *some* fallacy in it, might be shown by pointing out cases where false conclusions would result from applying it with proper modifications, though without essential change. It will, however, be more satisfactory to learn, if possible, in what particulars the reasoning is faulty.

On page 95, the angle BAD is determined by the condition that it be such as to contain all the lines which can be drawn through A, to meet FG or FG produced beyond G. Then it is said that CAD cannot be so conditioned as simply to contain all the lines that will *not* meet FG produced as before; for in that case AD must meet and not meet FG at the same time. Now this conclusion appears inadmissible. It is founded plainly on the assumption that in determining the angle BAD to be such as to contain all of a certain class of lines, every other line is excluded from it; in other words, that the line AD, which is the limit of a certain class of lines, must itself be comprehended in that class. This surely would not be an authorized assumption, even if it were not erroneous.

There are many cases in which difficulty may be occasioned by inattention to the kind of consideration we here advert to. In the case before us, a clear distinction is observable between AD considered as a limit of the lines which meet FG produced, and AD considered as the limit of those lines which do *not* meet FG produced. In the former case, the line AD belongs not to the class of lines limited by it, while in the latter, it is one of that class of lines which it limits. At the bottom of page 95, this important distinction is disregarded, when it is said that if AD is contained by BAD, it must meet FG or FG produced.

Further objections to the demonstration under notice, similar to those here suggested, might be advanced; but if the consideration which has been referred to be kept in view, they will readily occur to the reader.

A. D. S.

Bibliography.

1. *Notice of* Mr. Alger's Phillips' *Mineralogy*.—Prof. Gustav Leonhard of Heidelberg, Germany, has given a very favorable notice of Mr. Alger's book, (already reviewed in this Journal.) It appears in the Annals of the University of Heidelberg, and we abstract from it the following:—

"The fifth edition of a work is the best encomium upon its character, especially of one of a scientific nature. The first four editions of Phillips's work appeared in London; the fifth has now been published in Boston, edited by Mr. Alger, whose name was previously advantageously known by his beautiful investigations in Nova Scotia, and by the Essay which he published thereupon in common with Dr. Jackson. It was but very recently that we had occasion to allude in these pages to the scientific activity that reigns in the United States; and this work of Mr. Alger furnishes us with additional proof thereof. The Mineralogy of Phillips appears in a new dress, much improved and augmented. The minerals are arranged according to a chemical system. The most satisfactory and accurate analyses are given for each species, and there are additional analyses by Dr. Jackson and others, of American minerals, as Danaite, Cavanite, Hudsonite, Masonite, and Ledererite. The figures of the crystals, amounting to 600, are admirable, and there is much interesting information touching the occurrence of minerals, those of Nova Scotia and South America in particular. There is no doubt in our mind that Mr. Alger's Mineralogy, splendid as it is in its getting up, will find many readers. It is peculiarly adapted as a compendium for students."

2. *Die Meteoriten, or Meteorites in the Imperial Mineral Cabinet at Vienna;* by Paul Partsch. pp. 162, 8vo, with a plate. Vienna, 1843. —The Vienna cabinet of meteorites contains two hundred and fifty

eight specimens; they are from ninety four distinct meteorites, twenty five of which are of meteoric iron. Their physical characters are quite fully described by M. PARTSCH, and much information is added with regard to their geographical history. A table exhibiting their commerical value appended to the work, increases much its interest. The value of the Elbogen meteorite (iron) weighing 141 Vienna pounds* is stated at . . . . . 10,000 florins.

The Agram meteorite, weighing	70	pounds, at	.	10,000	"
An Atacama specimen, "	5	"	$5\frac{1}{2}$ loth,	506	"
Weston (Connecticut) meteoric stone, weighing	3	loth,		15	"
Nashville (Tennessee) "	"	"	$1\frac{27}{32}$ "	20	"
Richmond (Virginia) "	"	"	$3\frac{7}{8}$ "	36	"

3. *Works of the Exploring Expedition.*—Two of the scientific volumes of the Exploring Expedition under Capt. WILKES are just leaving the press, one by HORATIO HALL on *Ethnography* and *Philology*, the other by JAMES D. DANA on *Zoophytes*, including descriptions of species of corals. The latter is to be accompanied by an atlas of sixty one folio plates, containing several hundred figures, with colored drawings of the animals of many species.

4. *Die Rizopodi Caratteristeci dei Terreni Sopracretacei*, or *On the Characteristic Rhizopodi of the Supracretaceous deposits;* by G. MICHELOTTI. Modena, 1841.—This valuable memoir contains descriptions of these minute shells from different parts of Europe, and is accompanied by three plates, containing figures of twenty four species.

5. Dr. MANTELL will soon publish "Thoughts on Animalcules, or a glimpse of the invisible world, revealed by the microscope, with twelve plates, containing many colored figures of living Infusoria, and occupying about sixteen sheets."

Also by the same author, the seventh edition, with additions, of "Thoughts on a Pebble."

The author's "Wonders of Geology" are ready for a new edition, and he is preparing also, "A Geological Ramble round the Isle of Wight," and "Popular Lectures on the Nervous System."

Dr. MANTELL read, May 14, 1845, before the Geological Society, "Notes on the Microscopical Examination of the Chalk and Flint of the S. E. of England."—*See Mag. Nat. Hist., Aug.* 1845.

6. Mr. MURCHISON's long expected work on Russia, in two quarto volumes, is published.

7. *Report of the Exploring Expedition to the Rocky Mountains in the year* 1842, *and to Oregon and California in* 1843–44; by Brevet

* The Vienna pound is about one fifth greater than the English, i. e. 100 pounds English=81 pounds Austrian. The loth=one sixteenth of a Vienna pound. The florin=forty eight and a half cents.

Capt. J. C. Fremont, of the U. S. Topographical Engineers. Printed by order of the U. S. Senate. Washington, 1845. pp. 694, 8vo. With maps and plates.—This truly valuable report has reached us at the last moment. The first part we read with equal profit and pleasure two years since, and shall give a more extended notice of both in our next number.

8. *The American Electro-Magnetic Telegraph, with the Reports of Congress, and description of all Telegraphs known employing Electricity or Galvanism, illustrated by eighty one engravings;* by Alfred Vail. Philadelphia, Lea & Blanchard. This is a useful descriptive pamphlet of 208 pages, which is well timed, and will be read with interest by all who watch the progress of human affairs.

9. *Papers on Practical Engineering, (No. 3,)—On Sustaining Walls: Geometrical Construction to determine their thickness under various circumstances*; derived chiefly from a memoir of Mr. Poncelet, with modifications and extensions, by Lt. D. P. Woodbury, U. S. Corps of Engineers.—This is one of a valuable series of scientific papers now publishing under the enlightened superintendence of Col. Totten, Chief Engineer. The labors of the gentlemen of our army in the various departments of science are fast gaining them a well earned reputation.

10. *A History of Fossil Insects in the Secondary Rocks of England, &c.;* by the Rev. Peter Brodie, M. A., F. G. S. London, J. Van Voorst, 1845. pp. 130, 8vo, and 11 plates.—Such books as this are the reward of minute and patient investigation, and mark a mature state in the progress of science.

Obituary.

1. It is our painful duty to record the tragical death of Dr. Douglass Houghton, State Geologist of Michigan, which occurred on the night of October 13th, by drowning in Lake Superior. Dr. Jackson has sent us the following letter of particulars, which will be read with melancholy interest by all.

Boston, Nov. 9th, 1845.

Prof. Silliman: *My Dear Sir*—You have doubtless heard of the death of our estimable friend Dr. Douglass Houghton, state geologist to Michigan, and United States surveyor of the public lands in that state. I now communicate to you all that I have been able to learn respecting that melancholy event, which has deprived science of one of her most untiring votaries, the state of her geologist, and his friends of one of the most amiable and true-hearted of men.

Dr. Houghton, in addition to his duties as state geologist to Michigan, had made a contract with the United States government to run the

township lines on the public lands of that state, and had employed a number of distinguished surveyors, with their assistants, in performing the difficult and laborious task of the linear surveys, while he explored, so far as his other duties would allow, the geological features of the country over which the survey extended.

He had just been engaged in the important duty of conveying supplies by appointment to his surveying parties, and was returning to Eagle River, when the sad accident befel him which it becomes my painful duty to relate. On the 13th of October, with a party of four trusty French *voyageurs*, in a beautiful sail-boat which had been presented to him by his friends, he was on his way from the portage on the north side of Keweenaw Point to Eagle River, and had just passed a point of land, and was running along the shore to the mouth of the river, when a sudden northeast gale sprang up, accompanied by a heavy fall of snow, and a tremendous cross sea, driving on to a steep and rocky lee shore, obstructed his progress and jeopardized the lives of all who were in the boat. To land on that coast was impossible, for the sea ran as high as his boat's masts, and dashed upon the inhospitable rocks with great fury. The coast at that place consists of conglomerate ledges, dipping boldly into the lake at an angle of nearly 45°, and from ten to twenty feet high. Every exertion was made to keep the boat from being swamped by the sea, which blew directly over its sides. Once when the boat was half full of water, the men bailed it out, and then handed Dr. HOUGHTON his life preserver, entreating him to put it on; but he laid it down at his feet, and said that "there was no danger." This was evidently for the purpose of encouraging his boatmen.

The next moment the boat was filled and overturned. This took place at 8 P. M., three miles from Eagle River, and not more than twenty rods from the shore.

One of the men who had secured a hold on the rudder of the overturned boat, saw a hand rise out of the water, and seizing upon it drew up Dr. HOUGHTON, who after getting hold of the rudder also, pulled off his gloves and said to the man who offered him assistance, "Save yourself—I can get ashore easily."* Soon after a heavy sea struck the boat under her bows, and completely ended her over, and it is supposed that Dr. H. must have been stunned by the blow, for he sank immediately, and was not seen again. Two of his men were drowned with him, and two succeeded in reaching the shore, but were much bruised against the rocks, the sea often carrying them back into the lake after they had gained the shore, and dashing them on the rocks again with violence. At last they succeeded in laying hold of some bushes which grew in the

* Dr. HOUGHTON was a good swimmer.

crevices of the rocks, and saved themselves. Only one of the drowned men has been found, and his body was mangled and his brains were dashed out against the rocks. Every exertion was made by Col. Gratiot, of the Lake Superior Copper Company, to recover the body of Dr. Houghton from the lake, but thus far without success.

Thus has perished one of the most energetic and active of our state geologists, who lost his life near the scene of his labors, before he had been able to complete the monument of his scientific achievements, and benefit the world by the publication of his volumes of field notes, which must have been filled with important and valuable information.

Dr. Houghton, I understand, was born in Bolton, (Mass.) and emigrated in early life to Michigan. His age was about 45 years. He married young, and has left a wife and several children to deplore his loss. We offer our heartfelt sympathy, and lament with them the loss of a friend, whom we highly esteemed for his many virtues, and uniform courtesy and kindness. C. T. J.

2. Dr. William Horton.—This gentleman, who was well known to all cultivators of mineralogy in the United States, died at his residence at Craigville, in Orange County, New York, some time during the last spring. His inquiries were early directed to the exploration of his own district of country, so rich in rare and curious minerals. He was also for a time one of the geologists who conducted the survey of the State of New York. His latter years were clouded by a chronic melancholy which impaired his previous usefulness. He was a very modest and retiring man; and he has unfortunately left but few written evidences of his scientific acumen. We are unable to give the exact time of his death or his age.

3. William C. Woodbridge, long known for his philanthropic labors in the cause of education, died at Boston, Nov. 9, 1845, in the 51st year of his age. He was graduated at Yale College in 1811, and early devoted his efforts to the advance of the educational interests of his country. Being impressed with the opinion that the study of geography might be pursued in a more philosophical manner, he expended much time and labor in the preparation of a treatise on this subject, aided by Mrs. Willard. His services in this department were recognized by various Geographical Societies abroad by admission to membership. The "American Annals of Education," established and conducted by Mr. Woodbridge at Boston, enjoyed a high reputation, and contributed very much to incite the measures now every where in progress for the elevation of general education.